

# Market chain development in peace building

Australia's roads, wharves and agriculture projects in post-conflict Bougainville



Ian Scales and Raoul Craemer  
with Indra Thappa



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**February 2008**

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### **Disclaimer**

The views in this publication are those of the authors and not necessarily those of the Australian Agency for International Development (AusAID).

*Front cover photographs: Mini-dryer owned by matrilocal clan women, Rotokas;  
Huris loading cocoa at Kokopau wharf, locally-owned road grader on trunk road.*



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*Mount Bagana*



# Summary

This study assesses the impact of Australian aid to Bougainville through roads, wharves and agriculture projects, which were aimed at assisting its recovery from the armed conflict of 1989-1998.

The projects were parts of a loosely coordinated, multi-donor strategy of smallholder agricultural production and export market supply chain rehabilitation intended to boost Bougainville's economy through smallholder agricultural activity in the post-conflict period. Australian assistance was centred on restoring the export of Bougainville's premier export crop, cocoa to pre-crisis levels. The projects were implemented variously between 1999 and 2007.

## Australian Aid for Bougainville

Australian assistance to Bougainville infrastructure and agriculture consisted of four projects:

- Bougainville Coastal Trunk Road Rehabilitation Project (BCTRRP), 1999-2002, cost \$13.2M
- Bougainville Coastal Trunk Road Maintenance Project (BCTRMP), 2002-2007, cost \$24.2M
- Bougainville Wharves Rehabilitation Project (BWRP), 2002-2004, cost \$14.0M
- Bougainville Cocoa and Copra Dryer Rehabilitation Project (BCCDRP), 2001-2005, cost \$7.7M

## Purpose and scope of the impact assessment

This assessment examines whether the individual and combined effects of Australia's roads, wharves and agriculture projects assisted economic growth in Bougainville and contributed to peace-building. It further evaluates the cost efficiency of this assistance and whether this could have been delivered more effectively. Crosscutting issues of poverty, gender, HIV/AIDS and the environment have also been treated in the study.

The assessment employs two independent but integrated methods:-

- **Social impact evaluation** which focuses on the distribution of economic benefit within Bougainville, by region and by social category (poverty and gender). By comparing the outcomes for each region, it establishes the impact of economic changes on peace-building.
- **Cost-benefit analysis** takes a broad view of Bougainville's economy, comparing the overall outcome to the likely situation if the projects had not been provided. It establishes how much wealth the projects generated, comparing this to the cost.

## Findings

Australian support to transport infrastructure and agriculture has stimulated economic growth, supported peace-building and has been consistent with its gender, poverty and environment objectives. However, the impact of this assistance has been uneven.

### *Positive impact in the north*

In Buka and the northeast districts of Selau/Suir, Tinputz and Wakunai, returns to aid investment have been positive. Cocoa processing facilities provided by BCCDRP have enabled efficient processing of cocoa in smallholdings that were rehabilitated under a multilateral (partly Australian funded) seedlings project. Trunk road rehabilitation and maintenance provided through BCTRMP and BCTRRP in the northern regions has assisted smallholder cocoa growers to transport their produce to the market more efficiently.

Increased income from these projects has strengthened the smallholder farmer household economy and encouraged small business; there is some indication that ex-militants are putting the crisis of 1989-1998 behind them. ***The northern regions, where smallholder incomes have risen through improved agriculture and transport infrastructure, are now largely peaceful.***

### *Neutral impact in the south*

Restoration of economic activity in the southern districts of Arawa, Buin, Siwai and Bana has been restricted by low cocoa outputs with current yields lower than in pre-crisis times, which is attributed to rainfall pattern changes. The south which also contains about 50 percent of Bougainville's population is economically depressed. Due to high level of violence and lack of school facilities during the conflict, illiteracy and trauma are high among the young adults of the south. Problems associated with a youth bulge are compounded by a chronic lack of employment opportunities which has contributed to a lack of success in restoring peace to the south. ***The economic disparity between the north and south of Bougainville has potentially serious political and social implications and is a major governance challenge for the Autonomous Bougainville Government.***

This north-south disparity is fuelling migration from the south to the north. There are early signs of ethnic tension similar to that in the Solomon Islands. Economic recovery through market chain rehabilitation has also eluded the remote west coast communities, who have received assistance with rehabilitation of cocoa tree stock and crop dryers, but have no efficient transport links to market.

## Sectoral impacts

**Roads:** Trunk road rehabilitation and maintenance was carried out through local road contractors and community road teams. The participation of paid community road teams has increased equity by communities along the length of the road and has helped to keep the road free of disputes and closures. Capital investment encouraged through AusAID projects has helped to build up a local contractor base. Australian managing contractors attest to the high quality of work by these contractors. However, local contractors are tentative about their prospects because of uncertainty over future investment in roads.

**Transport services:** The road is now the primary means to freight export crops to market. A vigorous passenger transport industry has grown, fuelled by increased income

from the recovery of cocoa exports. About 80 percent of the population and associated school and health facilities are within 7 km of the road. Significantly, 20 percent still remain without effective transport services.

**Cocoa production:** About 14,000 tonnes of cocoa was produced in 2006, which is about level with average pre-crisis production. This increase has occurred twelve years earlier than anticipated. The BCCDRP has contributed substantially to this.

**Crop processors:** BCCDRP has assisted the rehabilitation of almost all known cocoa dryers in Bougainville, of which about half are new mini-dryers provided by the project. Through this support, a vital link in the production chain has been strengthened. However, with cocoa tree stock rehabilitation, Bougainville cocoa production has increased rapidly and many dryers are being used beyond capacity. At the same time, the supplied dryer furnace components are now reaching the end of their life.

**Micro-enterprise:** The Rural Development Trust Fund under the BCCDRP was not uniformly successful in creating rural small businesses. Micro-enterprises have succeeded near towns and in the cocoa-rich northeast, but have failed in the south and west where disposable income from cocoa has not materialised.

**Wharves:** Due to gaps in the allocation of wharf works between AusAID and EU and the withdrawal of EU from its commitments, the important cocoa wharves at Kokopau, Torokina and Wakunai have not received attention. Conversely, AusAID wharves in Buka and Kangu have been built far in excess of requirements.

## Lessons learnt

The assessment provides a number of lessons for further assistance to Bougainville and future post-conflict peace-building efforts elsewhere.

### Market chains in post-conflict restoration of peace

Australia's roads, wharves and agriculture projects have complemented the work of other donors, notably that undertaken by the UNDP to restore Bougainville's cocoa tree stock. The projects rehabilitated export crop production, strengthened processing and established transport links within and beyond Bougainville to get the crops to market. Principal lessons learnt were that

- cocoa yields, and hence overall levels of household income, were sensitive to the coherence of linkages between each of the three elements of smallholder market chain supply rehabilitation
- all three links in the chain: fulfilling cocoa potential by crop rehabilitation, rehabilitation of crop processing facilities and rehabilitation of transport access to market, are essential
- growth in household income appears to be a necessary but not sufficient condition for peace building and economic impact is interdependent with civil society and governance factors

The study has concluded that *smallholder market chain rehabilitation has been a necessary foundation for peace in Bougainville*. It was one of three essential peace-building interventions that were implemented in Bougainville, the other two being activities for civil society strengthening and good governance.

## Lessons for the project cycle

### **Lack of performance-linked strategic cooperation.**

Australia's roads wharves and agriculture projects were part of a multi-donor effort to restore the export crop market chain. However, the various projects were not clearly expressed as elements of this strategic objective. Projects undertaken simultaneously by the different donors, although complementary in purpose, were not coordinated. Consequently implementation gaps appeared, most visibly in the lack of rehabilitation of the main cocoa wharves in Bougainville. In future, *use of post-conflict market chain rehabilitation must be performance-linked to strategic objectives under a program structure*. Particularly, as a lead donor, it is in AusAID's interest to ensure that donor coordination is formally agreed and monitored from policy through to implementation.

### **Lack of strategic monitoring**

In the absence of a strategic objective, monitoring and evaluation remained focused on production targets under the infrastructure roll-out. There was no 'big picture' monitoring of overall strategic success during implementation. In Bougainville, the northeast in particular became supercharged due to project activities while the south remained stagnant. These trends emerged during implementation and had such monitoring existed, could have been detected and addressed. *Program-level strategic monitoring must develop frameworks to detect uneven implementation and outcomes and respond appropriately to address imbalances.*

### **Infrastructure roll-out without attention to institutional frameworks**

Many BCCDRP cocoa dryers were distributed without registration as required by the statutory regulator, the Cocoa Board. This, compounded by a surge in cocoa production created by market chain assistance and coincidental deregulation of cocoa buyer licensing created chaos for the regulator. Also, overcapacity use of the mini-dryers in this production surge environment has led to quality concerns for the regulator. The regulatory mechanisms have not been able to adjust quickly enough to the rapid growth in the cocoa sector. *Market chain programs must consider the capacity of established institutional frameworks and ensure that such programs do not upset existing regulatory systems.*

## Future directions

The strategy of smallholder market chain (SMC) rehabilitation for post-conflict peace building has supported Bougainville's agricultural export recovery, by an appropriate focus on infrastructure delivery through the RWA projects.

Market chain rehabilitation has not addressed regional differences in Bougainville and consequently its success has been tempered by the emergence of a pattern of uneven development within the province.

Bougainville is still in a phase of post-conflict recovery, but this state of affairs will not continue indefinitely. Post-conflict rehabilitation in Bougainville will need to be replaced by a new forward looking strategy with broader reach. Prior to this however, there needs to be a final transitional phase to address the uneven development that has arisen. Addressing this disparity is the unfinished business of market chain rehabilitation in Bougainville.

This study recommends that the strategic framework of smallholder market chain assistance is retained over a final transition phase, but that it is modified to target regional disparities. Two broad transitional options may be pursued:

- Supporting economic development in the northeast where economic recovery has been successful to increase Bougainville's gross domestic product to aid both government and business
- Assisting the highly populated and tension-prone south where economic recovery has not been successful will reduce sub-regional imbalances that may, if left unchecked, threaten the stability of Bougainville and its future.

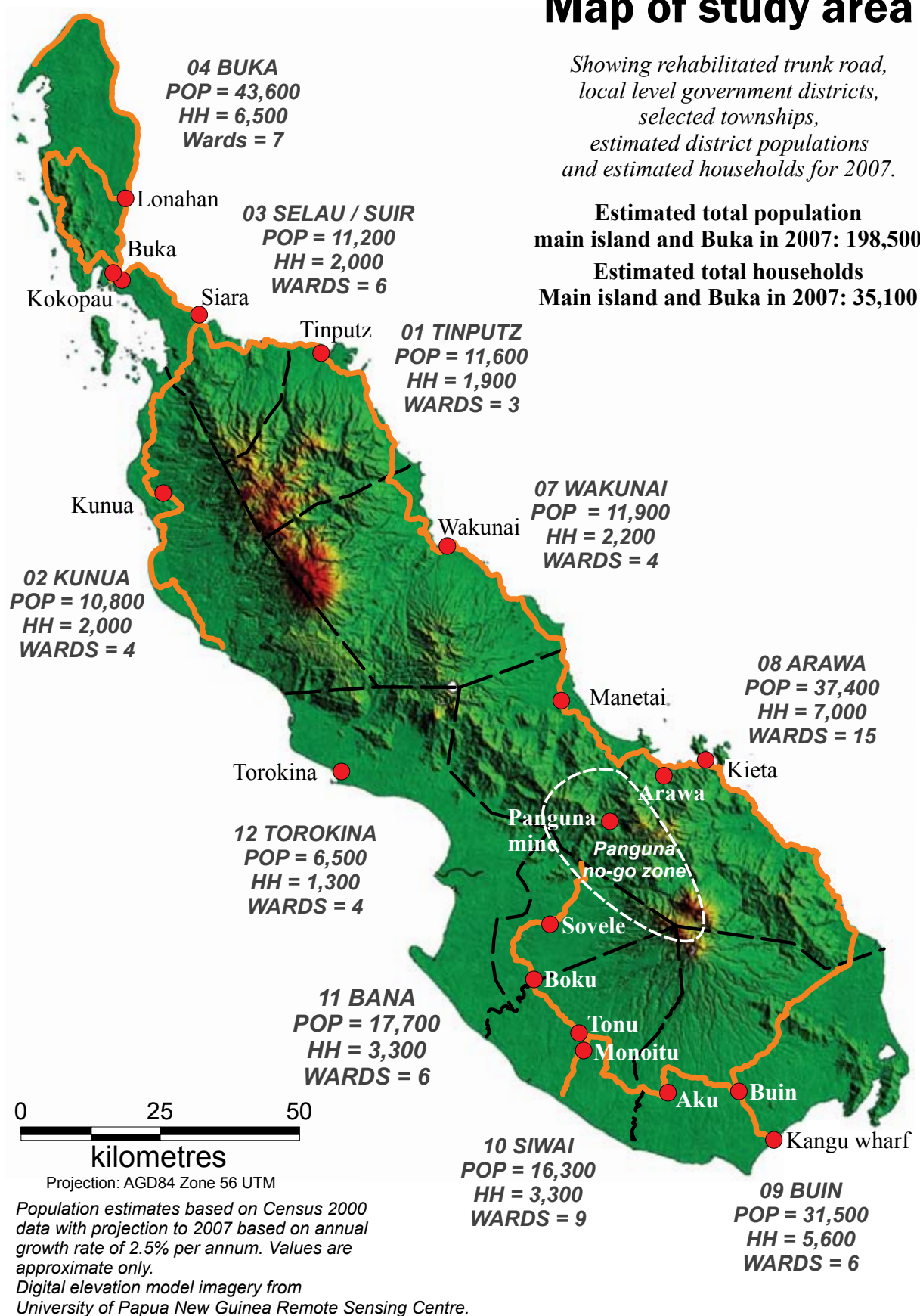
Beyond a transition to a broader economic strategy, a major factor in Bougainville's future is the independence referendum to be held between 2015 and 2020. Either continued autonomy or independence will be the outcome of the referendum. In either case, *a new forward-looking strategy will need to emphasise Bougainville's capacity for economic governance*. This will transcend the RWA project's focus on infrastructure. Until the referendum outcome is known, a conservative strategy that should be followed which:

- Engages with all of Bougainville's geographic regions and people
- maintains stability during the pre-referendum period through diversification and decentralization
- achieves a mix between traditional (subsistence) / modern (export) economy. Rural economic diversity should focus on the smallholder and reduce reliance on any one export market. Service delivery through networks involving government, business, grassroots and intermediary organisations should be progressively strengthened.
- stimulates growth to meet development goals (e.g. MDGs) in both economic and human development terms to improve wellbeing in Bougainville.
- recognises that while Bougainvilleans need household cash income, quality of life in Melanesia and its civil society rests on the strength of traditional social and economic bonds.

While emphasizing Bougainville's capacity for economic governance the strategy should base itself on the particular circumstances that confront Bougainville, some of which have been investigated by this study.



## Map of study area



**Figure 1. Map of the study area.**

# 1 Introduction

THIS STUDY ON MARKET CHAIN DEVELOPMENT in peace building assesses the effect of four Australian aid projects in post-conflict Bougainville, in the transport infrastructure and agriculture sectors. Together these projects formed part of a wider smallholder market chain rehabilitation effort. The projects were implemented to support Bougainville recover from the crisis of 1989-1998.

This section outlines the scope, purpose and methodology of the impact evaluation, followed by a description of the context of post-conflict donor assistance to Bougainville within which Australian Aid for roads, wharves and agriculture was set. It lays out the rationale for seeing the assistance to roads, wharves and agriculture as parts of a package to stimulate economic recovery by strengthening the agricultural market chain, and the role this may have played towards peace building.

## 1.1 Impact evaluation purpose and methodology

The four projects evaluated by the study were:

- Bougainville Coastal Trunk Road Rehabilitation Project (BCTRRP)
- Bougainville Coastal Trunk Road Maintenance Project (BCTRMP)
- Bougainville Wharves Rehabilitation Project (BWRP)
- Bougainville Cocoa and Copra Dryer Rehabilitation Project (BCCDRP)

Together, these projects make up a package that may be conveniently termed roads, wharves and agriculture (RWA).

The impact evaluation addressed four key questions:

1. What were the combined impacts of Australian assistance to agriculture and transport infrastructure on social and economic activities
2. Did the quantifiable economic benefits of the Australian assistance to transport infrastructure and agriculture on Bougainville outweigh the costs
3. Was Australian assistance to transport infrastructure and agriculture an appropriate intervention at this stage of the peace process
4. Were there ways that these projects could have been delivered more cost effectively?

### 1.1.1 Methodology and implementation

The study has two analytic components: 1) a socio-economic assessment and 2) a cost-benefit analysis.<sup>1</sup> The socio-economic assessment conforms to the principles of impact evaluation as defined by the World Bank (2004): ‘... the systematic identification of the effects – positive or negative, intended or not – on individual households, institutions, and the environment caused by a given development activity such as a program or project.’ The estimate of costs and benefits broadly embraces the World Bank (2004) definition of cost-benefit analyses as ‘tools for assessing whether or not the costs of

an activity can be justified by the outcomes and impacts', where cost-benefit analysis 'measures both inputs and outputs in monetary terms'.

A guiding assumption for both the estimate of costs and benefits and the social impact assessment is that their overall contribution to market chain development may have set into motion, dynamics resulting from the interplay of activities in the Australian Aid to Bougainville (AAB). A further assumption for the social impact analysis is that impacts, both individual and cumulative could be unevenly distributed across Bougainville. To test this, the social impact evaluation undertakes a qualitative assessment of economic impact at a district level. The cost and benefit estimate concentrates on the costs of the projects in relation to probable individual and cumulative project impact on the major export crop of cocoa across Bougainville.

### *Areas of impact to be addressed*

The central focus of this study is whether the AAB projects individually and combined assisted in economic growth and were effective in peace-building for post-conflict Bougainville. To this end, local economic impacts were assessed at the individual project level as well as through the assistance to the market chain.

The study also assesses the impact of trunk road rehabilitation on:

- Road construction and maintenance industry
- Development of transport services
- Access to health and education services

The study briefly considers the impact of the RWA projects on poverty and gender, HIV/AIDS and environment in terms of AusAID's cross-sectoral policies.

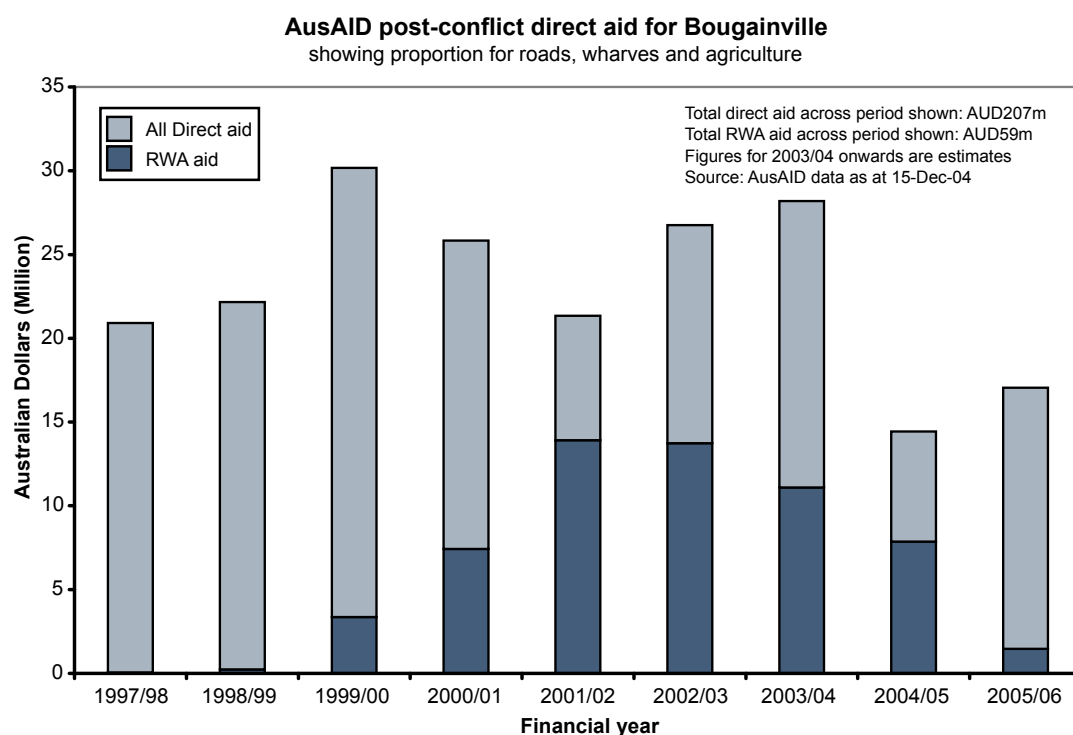
This evaluation of AAB projects in Bougainville includes Buka, but does not cover the Atolls and Nissan districts, which are within the North Solomons Province but offshore from Bougainville. The study area is shown in Figure 1.

### *Use of matched comparison*

In the absence of baseline survey data for measuring project impacts against the counterfactual, this impact assessment uses a quasi-experimental non-random retrospective 'control-group comparative matching' technique (see Baker 2000:66). The project area is divided into regions that may be compared and contrasted where regions have similar characteristics but, where one has received assistance while the other has not. Accordingly, Bougainville is divided into four regions to analyse the similarities and differences between each. As shown in Figure 2, this compares the roadless west with the road-connected east and, compares the north where less conflict occurred and economic recovery began earlier, with the south where conflict was prolonged and economic recovery delayed.

### *Research implementation*

AusAID contracted World Vision Australia Consulting Services (WVA) to carry out the study. WVA engaged Dr Ian Scales as Project Director and ACIL Tasman P/L. Primary fieldwork was conducted in October and December 2006 and February/March 2007 by Dr Scales, who gathered quantitative data, made transect surveys and conducted interviews in Buka town, and in the districts of Tinputz, Wakunai, Arawa, Buin and Torokina. The cost-benefit analysis (CBA) was prepared by development economist Raoul Craemer of ACIL Tasman with peer review by David Greig and further substantive contribution and editing by Dr Indra Thappa of AusAID. Scales prepared



**Figure 2. Australian Direct Aid in Bougainville, with RWA component**

the remainder of the study including photography (unless otherwise credited), original GIS implementation and mapping. Dr Indra Thappa supervised and edited the study for AusAID.

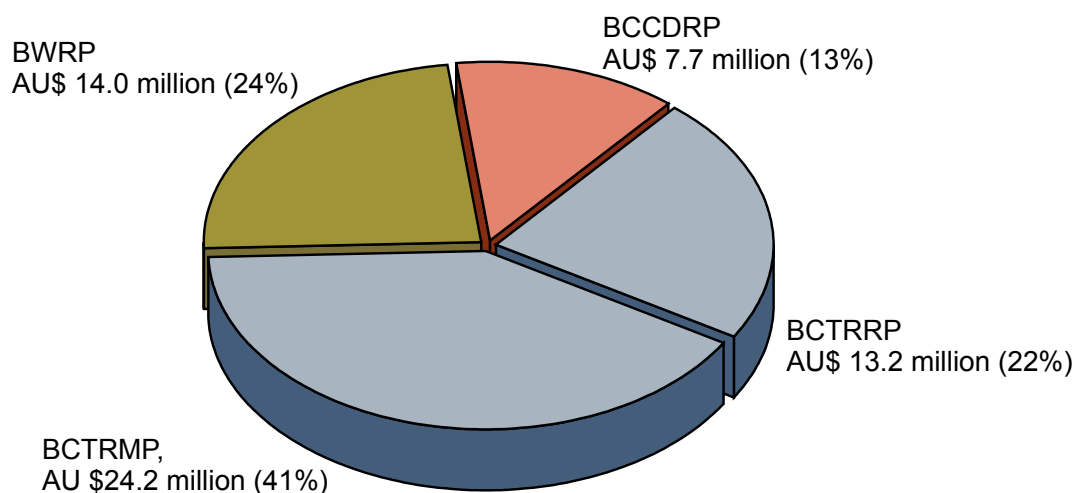
## 1.2 Australia's peace-building in Bougainville

Australian aid for Bougainville was a response to the need to support peace following the armed conflict from 1989 until ceasefire in 1998 and the signing of the Bougainville Peace Agreement in August 2001. Over eight years of war destroyed lives, infrastructure, social services and the formal economy. Bougainville emerged from the conflict traumatised, with a fragile peace process and meagre resources to rebuild.

### 1.2.1 Extent of Australian post-conflict assistance for Bougainville

In 1997 Australia committed \$100 million across five years to help further peace settlement efforts, promote reconciliation and reconstruct health, education and infrastructure services in Bougainville. Not all of this aid was allocated through AusAID; the Peace Monitoring Group was funded separately. Figure 2 shows AusAID annual expenditure from 1997/98 to 2005/06, indicating a direct expenditure of more than \$200 million across governance, law & justice, civil society, health, education, infrastructure, and rural development. This figure does not include Australian aid to Bougainville through the UN and other channels. Bougainville-specific post-conflict Australian aid peaked across the years 1999-2004. Increasingly after that period, Australian aid has been channelled through PNG sectoral programs rather than through specific allocations to Bougainville.

The four projects were part of the overall post-conflict assistance involving several donors and banks. Other donors including EU and NZAID also assisted peace-building



**Figure 3. Distribution of RWA project expenditure**

and restoration in Bougainville, either directly or through the UN agencies. This support focused mainly on social and economic rehabilitation. The strategy for economic rehabilitation was informed by a needs assessment by UN inter-agency missions in 1995 and 1998.<sup>2</sup>

Australia's initial emphasis was on rehabilitating essential infrastructure and restoring health and education. As conditions improved by 2000-01, there was a shift towards reviving economic activity. Aid was targeted at restoring the cocoa industry. AusAID worked to improve cocoa dryer capacity, as a complement to cocoa tree stock rehabilitation by UNDP. The maintenance of the coastal trunk road was also funded to improve access to services and markets. To enhance sea transport links, the wharf at Buka was upgraded and a jetty and warehouse constructed at Kangu in the south.<sup>3</sup>

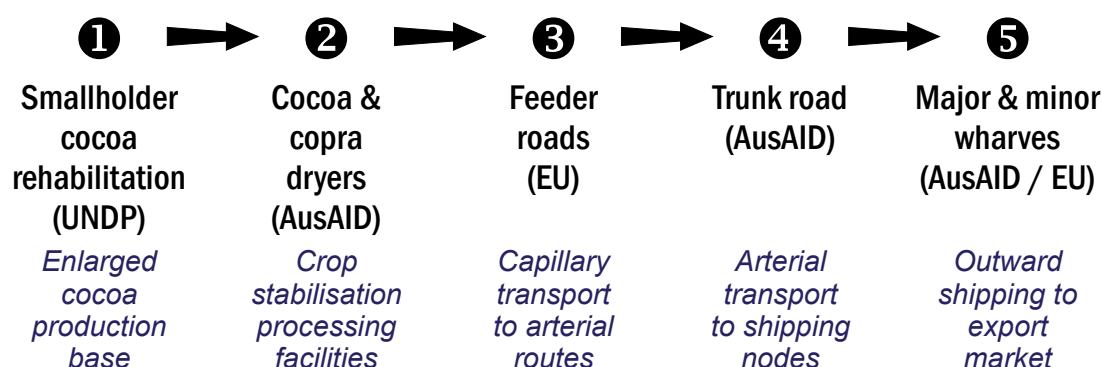
The BCTRPP, BWRP, BCTRMP and BCCDRP encompass the Australian component of this aid for roads, wharves and agriculture and are collectively referred in this document as RWA.<sup>4</sup> Figure 2 shows the proportion of Australia's direct aid allocated to RWA. Started in 1998, RWA expenditure peaked in 2001-2003 before phasing into the Transport Sector Support Program in 2008. From 1999/00, when BCTRPP began with road works, to 2005/06 when BCCDRP ended, RWA made up 36 percent of all direct AAB aid.

Figure 3 shows the distribution of expenditure on projects within RWA. The road projects (BCTRPP, BCTRMP) received most and together absorbed 63 percent of RWA expenditure. Wharves (BWRP) took 24 percent, while agriculture (BCCDRP) received 13 percent.

### **1.2.2 Intent and assumptions of Australia's RWA assistance**

A proposal was put forward in early 1998 for AusAID to rehabilitate agriculture in Bougainville with a strong focus on cocoa and copra. These export crops were widely grown in pre-crisis Bougainville and capacity could be rebuilt with relative ease. Agricultural rehabilitation would be complemented by the rehabilitation and maintenance of roads and shipping points under separate projects by EU and AusAID.<sup>5</sup> Mentioned briefly in this was an overarching smallholder agricultural production and market supply chain rehabilitation strategy aimed at quickly recovering capacity for rural income generation.





**Figure 4. Post-conflict agriculture market chain rehabilitation links**

Although the market chain strategy was briefly expressed in the 1998 project proposal, it does not appear again in the planning documents sighted for this study. As far as can be determined, it was not set down as an official strategy in Australia or elsewhere. At least one key actor believes that each donor project was started independently in response to various PNG government policies for restoring Bougainville in the mid 1990s and scoping missions undertaken in the late 1990s.<sup>6</sup> Certainly the choice of wharf projects stemmed from proposals in 1995.<sup>7</sup> No reference is found in formal project goals or objectives to an overarching strategy for market chain rehabilitation and the donors implemented their projects independently of each other.

It is largely accidental that today, the overall appearance is that of a multi-donor program in which the donors worked on five different sections of smallholder agriculture production and supply chain rehabilitation. UNDP concentrated on smallholder cocoa rehabilitation, AusAID worked on three sections of the supply chain: copra and cocoa dryer rehabilitation, the trunk road and major wharves, while EU focused on feeder roads and further wharf rehabilitation (Figure 4).

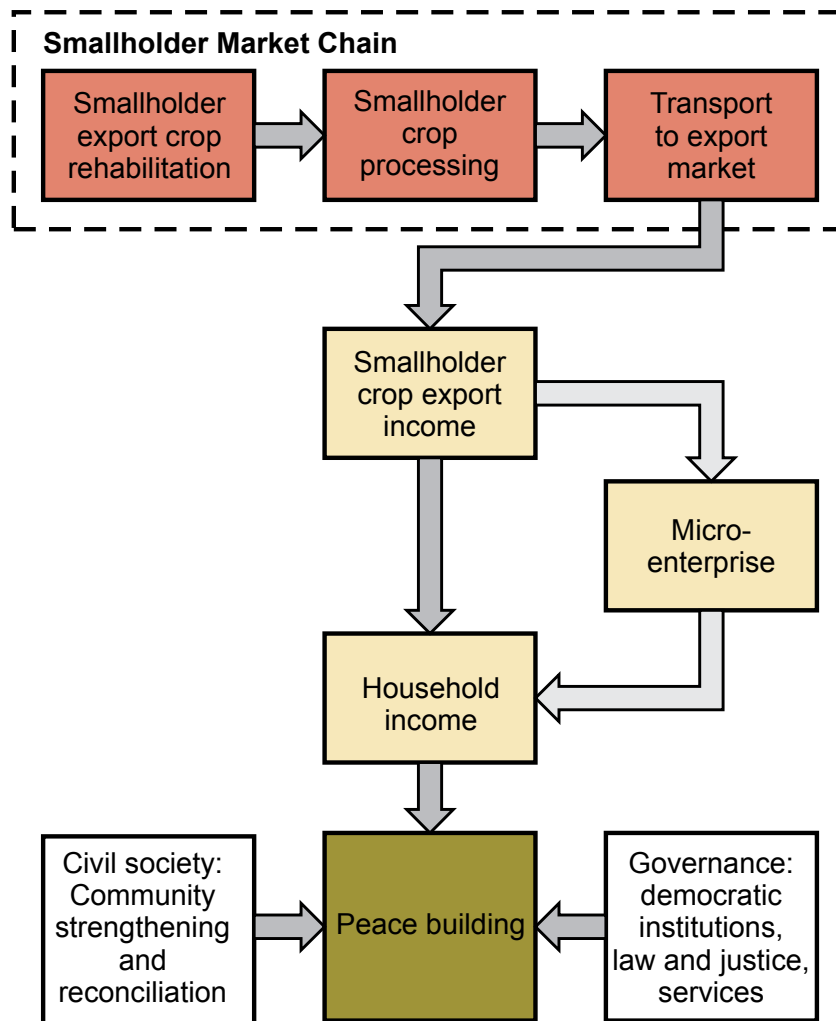
For analytical purposes it is useful to consider the RWA projects and those of the other donors as parts of an integrated program as depicted in Figure 4. While the study focuses principally on the interaction between the Australian aid components, it is important to note that the outcome resulted from the combined effort of all the donors.

The following discussion focuses on the central concept of ‘smallholder agricultural export production and market supply chain rehabilitation’. For convenience, this is abridged to ‘Smallholder Market Chain rehabilitation’, or SMC.

#### *Role of SMC in strategies for peace building*

Notwithstanding a lack of a strategic view of SMC among the donors in the early post-conflict period, it was intuitively adopted in the overall post-conflict response in Bougainville. Figure 5 clarifies the shared assumptions apparently held by donor agencies, of the role of SMC in Bougainville’s post-conflict peace building. This shows SMC as essentially a three-step process of rehabilitating an export crop, rehabilitating crop processing required and rehabilitating transport linkages to market. Strengthening of market supply institutions (such as marketing organisations and regulatory agencies) was not undertaken.

Theoretically, when income is returned from export crop sales, it is possible to assist development of local businesses that rely on sales within local markets fed by export crop income. Household income is then supplied from either smallholder cropping or



**Figure 5. Role of SMC rehabilitation in peace-building strategy**

alternatively from these downstream businesses. This household income, if sufficiently widespread among the population and if of sufficient quantity to alleviate poverty, can then become a direct factor in peace building.

SMC is by itself insufficient for peace building. Figure 5 depicts the household income economic input of SMC as just one of three essential inputs to peace building; the other two being civil society and governance.

It is also noteworthy that in a post-conflict situation, peace building is preceded by a stage of peace keeping. In Bougainville, this occurred through the deployment of the Peace Monitoring Group prior to intervention with Australia's infrastructure and agriculture projects. Further, there was a specific gender dimension to peace building assistance. Prior to the mobilisation of the RWA projects, AusAID conducted a gender in development appraisal to inform the AAB activities.<sup>8</sup>

The role of agriculture in peace-building has not been extensively researched. The key paper in this field by Addison (2005) concludes that 'Agricultural development can contribute significantly to peace by raising incomes and employment, thereby reducing the social frustrations that give rise to violence'. The present study provides an opportunity to empirically investigate Addison's thesis. If sufficiently robust, then the lessons learned from Australia's contribution to peace building in Bougainville through

smallholder agricultural market supply rehabilitation may have significant international relevance.

### *Multiple roles of post-conflict road infrastructure*

The role of roads for agricultural market supply has been identified above. However, the major component of RWA, the trunk road, was also seen to be important not just for economic recovery but also for supporting the other two essential inputs to peace building identified in Figure 5, i.e. civil society and governance. Aside from its position in the market supply chain, the road was envisaged as critical to the inflow of services, law and justice, movement of government officials and of people involved in reconciliation and community strengthening. The trunk road then had a multiple role in supporting the full range of inputs to peace building in Bougainville.

There is a large body of international literature on the role of roads in rural poverty reduction in situations other than post-conflict. Recent work of relevance includes Windle and Cramb (1997), Hanmer *et al.* (2000), van de Walle (2002), Gibson and Rozelle (2003), Njenga and Davis (2003), Hughes (2005) and Hettige (2006). For Bougainville the only previous study of this type is by Ward (1975). The present study covers different ground from this literature in the study of roads and poverty reduction, by focusing on the role of roads in SMC rehabilitation for peace building.

# Bougainville Coastal Trunk Road

Showing bridges, causeways and wet crossings; lengths of BCTRMP inventory road sections

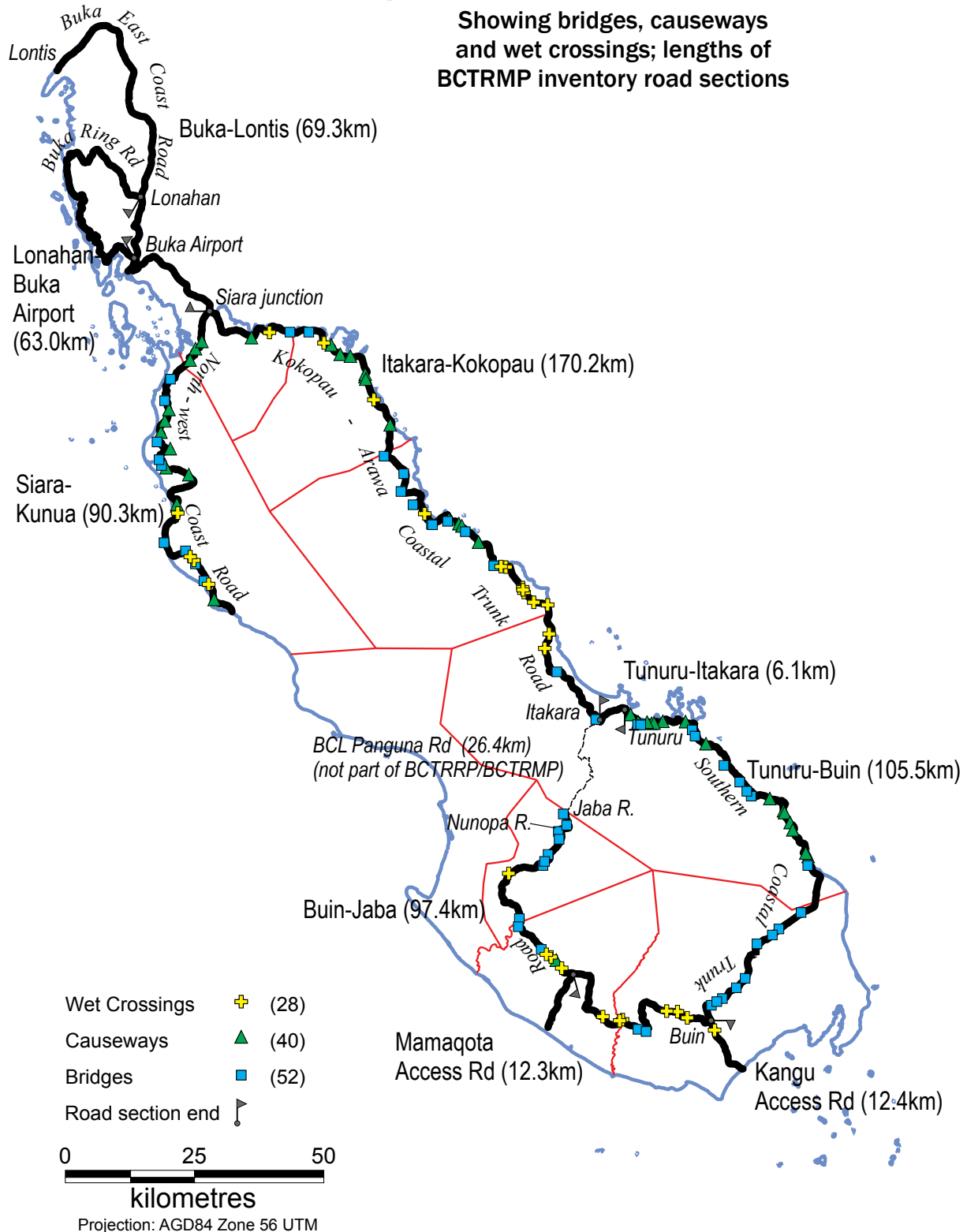


Figure 6. Bougainville coastal trunk road map

## 2 Project descriptions

THE ORIGINAL OBJECTIVES, COSTS, TIMEFRAMES and outputs of each of the AAB roads, wharves and agriculture projects are set out in this section, drawing on previous project documentation.

### 2.1 Bougainville Coastal Trunk Road Rehabilitation Project

The Bougainville Coastal Trunk Road Rehabilitation Project (BCTRRP) began in August 1999. Works started in April 2000. The project goal was to assist in the economic, social, institutional and political rehabilitation of Bougainville by providing a more reliable transport link through the restoration of sections of the main trunk road.

The project had two objectives. First, to restore unsealed sections of the trunk road from Kokopau through Arawa, Buin and Boku as far as the Nunopa River and access roads to the proposed wharves at Mamagota and Kangu (Figure 6).<sup>9</sup> Second, to promote support for the project by involving of the local community. The project was managed by a joint venture of Barclay Mowlem Construction and Queensland Consulting Project Partners (QCPP), operating under the counterpart ABG Department of Technical Services and Department of Works. Total AusAID contribution to the project was \$12.66M, with the counterpart contributing salary costs of counterpart staff.<sup>10</sup>

### 2.2 Bougainville Coastal Trunk Road Maintenance Project

The Bougainville Coastal Trunk Road Maintenance Project (BCTRMP) began in April 2002, following on from the BCTRRP. The BCTRMP was in response to a request in 2001 to AusAID from the Interim Bougainville Provincial Government (IBPG) to assist road infrastructure for a further three years after completion of the BCTRRP. The objective of the project was to maintain the trunk road to a trafficable standard using local resources and to strengthen local capacity for future road maintenance. Initially maintenance works were to cover a 327km section of trunk road on the main island.

In late 2002, AusAID agreed to expand the scope to include rehabilitation and maintenance of the Buka Ring Road and Northwest Bougainville Coast Road and work on all sealed road pavements, except for roads within the Panguna no-go zone in central Bougainville. This nearly doubled the project scope, covering about 620km of both sealed and unsealed pavements as well as numerous bridges and associated drainage structures. The managing contractor and counterpart were as for the BCTRRP. The initial contribution in May 2002 of \$7.53M had increased to a final contribution of \$28.41M by completion of the project. The counterpart provided an additional estimated \$40,000 per annum to cover counterpart staff salaries.<sup>11</sup>



## 2.3 Bougainville Wharves Rehabilitation Project

Following project design in mid-2000 the Bougainville Wharves Rehabilitation Project (BWRP) was implemented with the main construction phase from October 2002 to May 2004. The goal of the BWRP was to assist in the economic and social development of Bougainville by supporting efficient transport and trading routes to the rural areas. The project aimed to improve sea transport facilities to allow the import of essential goods to southwest Bougainville and to export cash crops from this region. This was achieved through three construction components in different locations:

- Rehabilitation and extension of the existing PNG Ports Corporation wharf at Buka to incorporate a container wharf and landing craft ramp.
- New jetty, landing craft ramp, storage shed and weighing facilities at Kangu Beach, Buin.
- Storage shed, hardstand and weighing facilities at the inland site of Panakei in Siwai.

A fourth component consisted of project management.<sup>12</sup>

At Buka, the works comprised a 60m long concrete wharf suitable for berthing of 7,300 DWT ships and handling of 20ft long containers, approximately 1.2ha pavement for port working area, a concrete barge ramp and barge berth, with associated drainage, fencing and minor works. The works were taken over by Ports Corporation PNG at Buka on 8 September 2003. The estimated final cost of this component was \$2.759M.

At Kangu, works consisted of a jetty suitable for berthing of 1,000 DWT ships and handling containers on road vehicles, a barge ramp, storage shed and a covered loading area suitable for storage of 2,400 tonnes of cocoa, with associated earthworks, drainage and access roadways. The completed facilities at Kangu were handed over to the IBPG on 8 April 2004. The estimated final cost of this component was \$6.273M.

At Panakei in Siwai, works comprised construction of a storage shed and covered loading area suitable for storage of 2400 tonnes of cocoa, with associated earthworks, drainage and access roadways. At Panakei, the completed works were handed over on 26 May 2004. The estimated final cost of this component was \$1.835M.

Additional project management costs for BWRP amounted to \$3.222M, bringing the final estimated cost of BWRP to \$14.090M.<sup>13</sup>

## 2.4 Bougainville Cocoa and Copra Dryer Rehabilitation Project

Although the BCCDRP had a lower budget than the transport infrastructure projects, it was more complex and for its direct beneficiaries, entailed a potentially profound impact. Because of its complexity and the range of impacts, the project is described here in detail.

Post-crisis AusAID work on agriculture in Bougainville began with the PNG-AusAID Agricultural Sector Project Identification Mission of October-November 1997. This led to the agriculture rehabilitation proposal in 1998 mentioned in Section 1.2.2. It took into account the UNDP proposal to distribute two million cocoa seedlings each year for five years. It set as a major outcome, the recovery of cocoa and copra production to pre-crisis levels within ten years. Rehabilitation of smallholdings on customary land was chosen as the strategy from a range of four possible options.<sup>14</sup> The proposal mooted

the rehabilitation of fermentaries and dryers.<sup>15</sup> In addition, a livestock rehabilitation component (mainly for poultry and pigs) and a women's small business micro-credit component were also proposed. Much from this initial proposal can be seen in the ultimate design of BCCDRP.<sup>16</sup>

A project design mission in September-October 1999 made recommendations on assistance to rehabilitate cocoa and copra processing capacity. In part, this was based on UNDP estimates of the need for 1,000 to 1,200 new small-scale cocoa fermentary/ dryers and the repair and rehabilitation of a similar number. BCCDRP phase 1 was implemented from November 2000 to February 2004. An extension Phase 2 was later approved and was implemented from April 2004 to April 2006.<sup>17</sup> Phase 2 was budgeted at \$2.734M.<sup>18</sup>

The project purpose as stated in phase 1 was to assist recovery of processing capacity in the cocoa and copra industries. This was to be achieved through six components:

1. **Rehabilitation of cocoa dryers.** More than half the pre-crisis dryer capacity was to be rehabilitated, with 800 pre-crisis cocoa fermentaries and dryers to be provided with materials subsidised by the BCCDRP.
2. **Small cocoa fermentaries and dryers.** This was to provide opportunities for economically or socially disadvantaged growers to participate. Two outputs were proposed. First, 450 small pre-fabricated fermenting boxes and dryers were to be distributed at a subsidised price. These were to be registered and operated by special interest growers including youths (among them ex-combatants), women, widows and farmers in disadvantaged areas. Second, extension training to special interest growers was to be developed and delivered by DPI and CCEA and resourced by the project.
3. **Rehabilitation of copra dryers.** To restore copra drying capacity to near pre-crisis level of 1,500 dryers, 600 copra dryers in copra producing districts were to be rehabilitated and registered.
4. **Forestry seedlings for firewood replacement.** To reduce environmental damage and provide for future wood requirements especially in areas where lack of firewood to operate hot air cocoa dryers is acute, 250,000 forestry seedlings were to be provided. These, for future firewood and building supplies, were to mitigate the effects of tree felling. Fruit tree seedlings were also to be distributed for subsistence and cash. Dryer recipients were required to plant and tend a minimum of 50 trees.
5. **Rural Development Trust Fund.** The 25 percent equity up-front cash contributions required of dryer recipients were to be recycled into diverse small scale community-based agricultural or rural development projects, as a further project benefit extending to community members other than dryer recipients.
6. **Project management, coordination and monitoring.** To implement activities on time and within budget.

Components 1, 2 and 3 were to directly address the project purpose, component 4 aimed to mitigate environmental consequences and component 5 reapplied contributed funds to further agricultural development. Component 6 (management) oversaw the project as a whole.

BCCDRP further required: 1) dryers to be made by Bougainville-based small businesses 2) a cash contribution by dryer recipients, 3) preferential targeting of disadvantaged groups such as widows and ex-combatants and 4), coverage of all cocoa and copra producing districts. The fermentary/dryers provided or rehabilitated by the project were to be promoted as community facilities, although conversely they were proposed to be

mini-box fermenters for household-scale fermentation.<sup>19</sup> Fermenter boxes were to have a capacity of 200kg, as against the 'standard 1,000kg box' which the design team deemed inappropriate for small growers.<sup>20</sup>





Phase 2 of BCCDRP dropped the rehabilitation of existing cocoa and copra dryers, reducing the number of components to four. A projected further 600 mini-dryers were to be supplied with owner equity increased to 35 percent. A further 150,000 tree seedlings were also to be distributed. The Rural Development Trust Fund was given a target of 700 additional projects, with owner equity increased to 35 percent and maximum limits raised to K2000 per individual and K2500 per group. Phase 2 was also to target particular socio-economic groups and geographic areas that did not fully access the project in Phase 1. These included women and groups in the Atolls, Kunua and Torokina LLG districts and in the 'no-go zones'.<sup>21</sup>

# 3 Social impact evaluation

THE SOCIAL IMPACT EVALUATION HERE explores impacts of AusAID's RWA assistance on local economy, poverty and gender, education and health access, impacts on HIV transmission, impact on the peace process and impact on the environment. The main thrust of the social impact evaluation however is to establish the impact of the RWA projects on the rehabilitation of the smallholder market chain (SMC). For this, the study undertakes an evaluation of geographical and social distribution of the social and economic impacts to arrive at an overall statement of social impact.

To simplify the analysis of geographic patterning in the Bougainville economy and to compare the relative impact between regions, Bougainville is divided into four economic regions, roughly following north-south and east-west axes. Table 1 outlines the broad characteristics of each economic region. Each economic district is based on local level government (LLG) district boundaries, so as to utilize existing LLG-level data. Summary data shown in Table 1 is brought forward from the analysis conducted further on in this study. It shows the great differences between districts in gross income from agricultural exports and indicates the stark disparities in gross per-capita income from these exports.

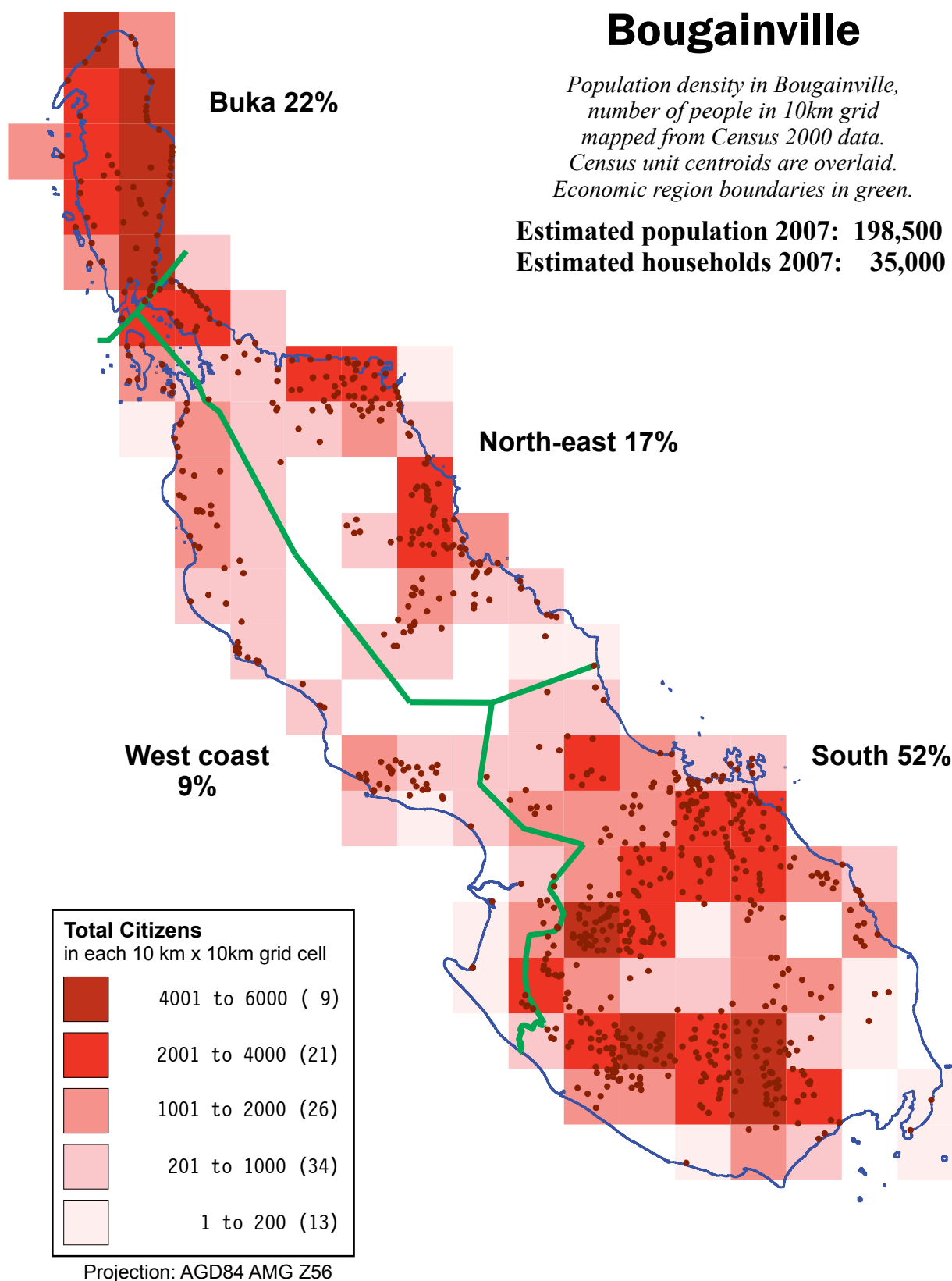
**Table 1. Economic regions of Bougainville defined by this study**

ECONOMIC REGION	LLGs	DESCRIPTION	POP 2007 (est.)	COCOA (est.)	COPRA (est.)	SHARE OF GROSS AGIL INCOME	GROSS AGIL INCOME PER CAPITA
Buka Island 	Buka	Buka Island has a high population density, proximity to the present Bougainville capital of Buka Town, and a separate road network unconnected to mainland. Produces most copra and is also reliant on employment in Buka Town.	43,600 22%	1,200 T 8%	8,960 T 70%	K9.3M 14%	K214
North-east Mainland 	Selau/Suir Tinputz Wakunai	This zone comprises most of the busiest section of trunk road, that between Kokopau and Arawa. Tinputz and Wakunai are the main cocoa producing LLG districts of Bougainville. It is by far the richest region of Bougainville	34,700 17%	8,700 T 58%	640 T 5%	K34.8M 53%	K1,003
West Coast 	Kunua Torokina	Relatively isolated and with low population density (and corresponding low agricultural production), Torokina and parts of Kunua rely on sea rather than road transport. The north of Kunua produces copra.	17,300 9%	1,350 T 9%	2,560 T 20%	K6.6M 10%	K385
South Bougainville 	Arawa Buin Siwai Bana	The southern LLG districts of Arawa, Buin, Siwai and Bana exhibit high population densities, low agricultural potential and significant law and order problems. Vanilla is the most likely crop for this district, although its production is stalled by lack of market. The poorest region.	102,900 52%	3,750 T 25%	640 T 5%	K15.2M 23%	K148

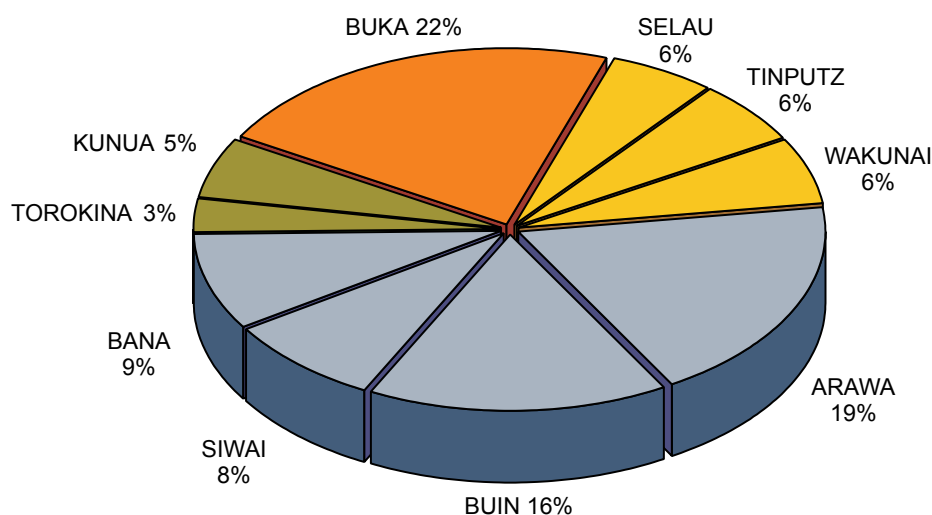
# Population Density Bougainville

*Population density in Bougainville,  
number of people in 10km grid  
mapped from Census 2000 data.  
Census unit centroids are overlaid.  
Economic region boundaries in green.*

**Estimated population 2007: 198,500**  
**Estimated households 2007: 35,000**



**Figure 7. Bougainville population density map.**



**Figure 8. Population distribution by LLG district (Buka and mainland only)**

## 3.1 Social, economic and geographic context in Bougainville

The impact of Australia's RWA assistance to Bougainville is unevenly distributed. The main factors contributing to this are spatial differences with respect to agricultural productivity, population, transport costs, social factors, the success of the peace process and law and order.

### 3.1.1 Bougainville population and land tenure

The following section of the study relies on comparisons in relation to population levels between districts. Further, land tenure issues relevant later in the study are also discussed here.

#### *Settlement patterning and density*

Relative to the rest of PNG, Bougainville has moderate to low population density.<sup>22</sup> Much of the population is rural, living in scattered villages and hamlets. Human settlement is associated with land of good agricultural potential, particularly that for cocoa. This is less so for Arawa district where a large population is not associated with land of good agricultural potential, but rather appears to be the relic of settlement organised around the now-defunct BCL copper mine at Panguna (see Figure 12). Population is urbanised only in the two town centres of Buka and Arawa. Central places in the other districts are undeveloped.

The last census was undertaken in 2000 immediately after the hostilities ceased. Enumeration teams could not cover the south comprehensively resulting in undercounting in some areas.<sup>23</sup> It is also understood that many people returned after the census was taken, probably attracted back from circulatory labour migration in other parts of PNG by prospects of economic recovery. However, this undercounting in the census is not expected to affect the conclusions of this study.

Figure 7 maps population density in a 10km grid. It reveals high population density in Buka, small population centres in Wakunai and Tinputz, and an arc of high population



extending through from Arawa across Panguna to Bana and around to Siwai and Buin. The share of population by LLG district is shown in Figure 8. Significantly, the population in the southern districts is about half the total population of Bougainville, while that of Buka is almost one quarter. The two west coast districts are sparsely populated.

Provincial population growth in 2000 was estimated as 2.4 percent per annum (Hanson et. al. 2001). The post-conflict rates may be as high as 3 percent per annum. If the rate is assumed at 2.5 percent, the population in 2007 is about 198,500 in the study area (Bougainville and Buka, not including Nissan and Atolls). Calculated at the same rate, there are an estimated 35,100 households in the study area. A tabulation of estimated population by LLG district for 2007 is provided in Annex 1, and the main 2007 estimates shown in Figure 1.

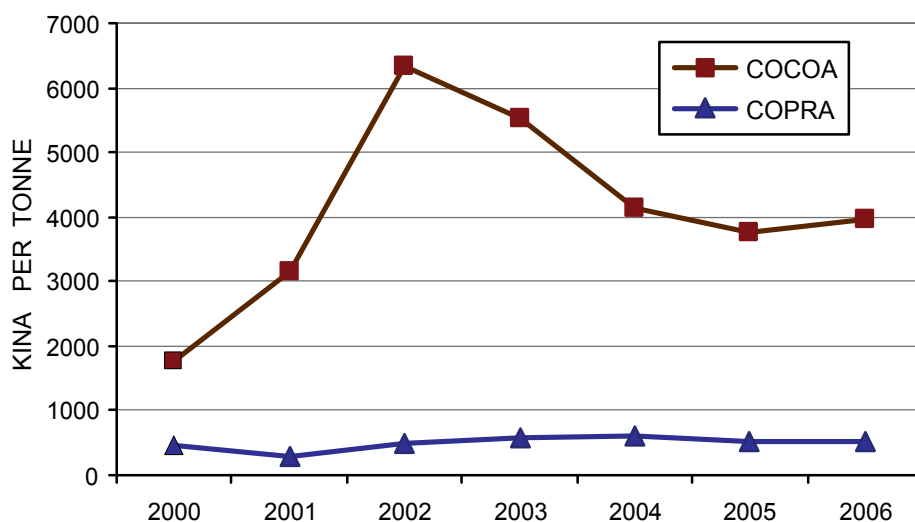
### *Land tenure*

Almost all of Bougainville is currently under control of customary land tenure systems. Smallholder agriculturalists are situated within this system through their hereditary association to their mother's or, more rarely, father's clan. Customary land tenure is fundamentally tied to customary governance institutions, which ideally lowers costs of governance for government. The widespread entitlement to farming land under this system also prevents the abject poverty experienced by landless peasants in other countries. In Bougainville, the interface between government and customary governance has been bridged since 1996 by Councils of Elders in each district. In agricultural areas, tenure under customary governance is mostly functional and undoubtedly has assisted peace building.

In urban areas, mission and government stations and plantations, the situation is different. In pre-crisis times, these areas were alienated under colonial and then PNG national legal title. This title was not recognised by secessionists during the conflict. State power in post-conflict Bougainville is too fragile to assert legal title. Indeed many politicians who were part of the Bougainville secession movement take the view that many legal titles are illegitimate or at least should be co-governed by customary landowners. In addition, differing local versions of who has underlying customary rights has led to a situation where legally titled land is in many cases now claimed by more than one customary landowner or landowning group. Thus, valuable plantation areas remain in limbo and for land they hold title to, government, mission and business interests must now undertake negotiation with various 'landowner' claimants. This includes wharf sites (including Buka and Kangu). Where rent-seeking occurs, or landowner agendas conflict with each other or with proposed development, this is causing much frustration. Many business people in urban Buka and Arawa say this affects their business (often due to high rents) and is stymieing the development of district townlets. Customary control over these areas is retarding spatial elaboration of the economy. More generally the absence of clear title which supports security for borrowing, also deters investment in local business.

### **3.1.2 Agricultural production in Bougainville**

Agriculture in Bougainville combines subsistence agriculture, agriculture for local market sale and export cash cropping (see Bourke and Betitis 2003). Cocoa is the main export crop followed by copra. Vanilla was promoted in the early 2000s as a third



**Figure 9. Comparison of cocoa and copra prices**

alternative, but the market became more selective with expansion of international supply. At present, agricultural export is confined to cocoa and copra.

Distribution of cocoa and copra is uneven across Bougainville. Production within each district is determined by natural factors of rainfall, soil and slope, human settlement patterns, market access and market prices. Recently with higher cocoa prices, farmers have shifted away from copra wherever they can do so. Figure 9 compares the average fair merchantable price per tonne of copra, with the average delivered-in-store price per tonne of cocoa over recent years.<sup>24</sup> Cocoa prices have risen while copra prices have remained steady. In 2006, cocoa realised a price almost 8 times greater than copra. Thus, given a choice, farmers tend to choose cocoa. Even so, copra is a major secondary crop for Buka Island, parts of Kunua and Selau/Suir, and is produced substantially in Arawa district.

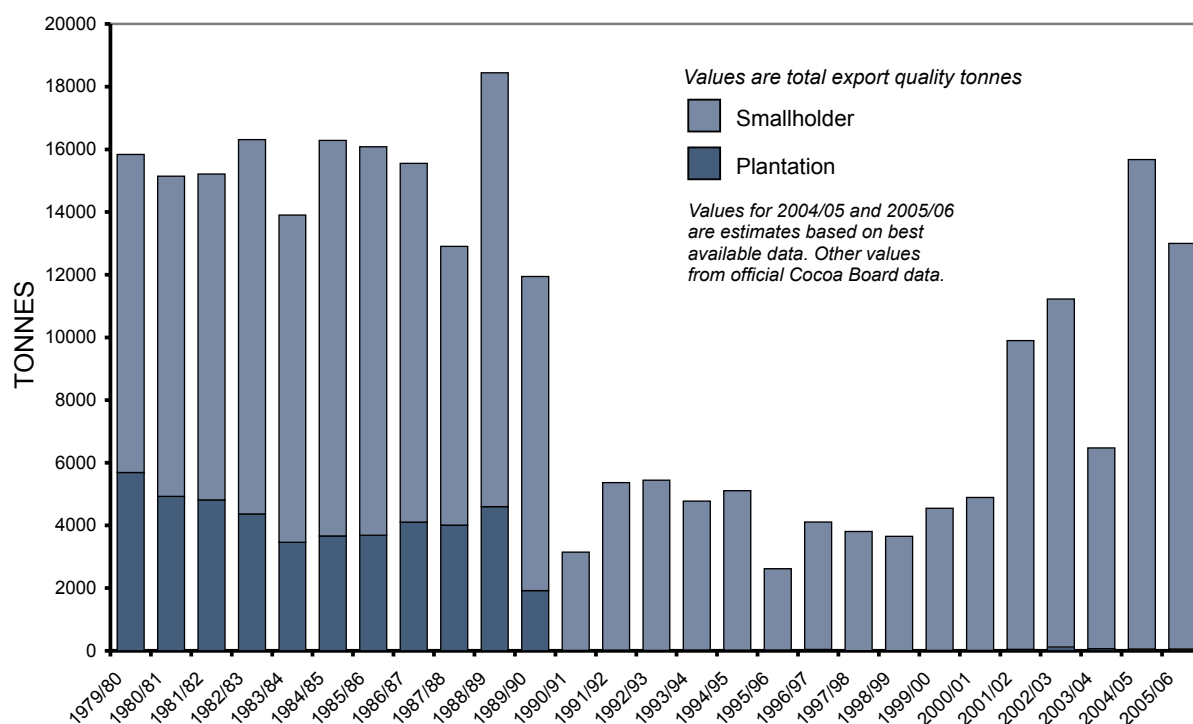
Estimates of copra and cocoa production in 2006 for Bougainville are derived below. In summary, they are: about 12,800 tonnes of copra and about 15,000 tonnes of cocoa. Using average prices paid to growers by major dealers in 2006, copra was bought at K513/tonne, and cocoa at K3,963/tonne.<sup>25</sup> This infers that gross income from copra in 2006 was K6.555M and from cocoa, it was K59.445M. Cocoa's share of the gross combined income of K66 million was 90 percent, that of copra 10 percent. Share by economic region is tabulated in Table 1.

### 3.1.3 Cocoa production

Cocoa, the main export crop produced in Bougainville is mainly transhipped in bags by coastal ship to Rabaul, from where it is exported to international chocolate manufacturers. In the following discussion, 1) annual average tonnages will be compared across three periods: pre-crisis, crisis, and post-crisis, and 2) current production by district will be estimated.

#### *Production during and prior to crisis.*

Bougainville pre-crisis was a major producer of cocoa. An annual average of about 15,600 tonnes per year was produced in the ten years prior to the crisis (1979-1989). Of this, about 28 percent was grown in plantations. 1988/89 was the last year of full



**Figure 10. Bougainville annual cocoa production 1979-2006**

production of cocoa before the crisis with output peaking at 18440 tonnes. Plantation cocoa ended with the spread of the crisis during 1990/91 and has never recovered. The plantations remain generally un-maintained, although during and after the crisis there has been some informal harvesting of plantation trees.

Smallholder cocoa plantings were neglected during the crisis, with a severe decline in production during that period. Plantations were in a similar state. According to official figures, in the ten years 1990/91 to 1999/2000 annual cocoa production flattened to an average of about 4300 tonnes equating to 38 percent of average pre-crisis annual production.<sup>26</sup> Practically all of this was produced by smallholders (Figure 10).

The post-crisis recovery of the industry was constrained by three agricultural factors: a reduction in productive tree stock by 20 million due to poor maintenance, drought and fires (Kondorr and Rahmann 1999); the collapse of the plantation industry that had provided about one quarter to one third of pre-crisis production and the poor state of cocoa dryers. The poor standard of transport services and social disarray also constrained recovery. Nevertheless, smallholders began to return in greater numbers as peace initiatives succeeded, leading to a jump in production during 2001/02. The early phase of the recovery however was not reflected in the official production figures of the Cocoa Board. The 2000 UNDP Mission Report stated that production was not static in the years 1997-2001 as indicated in official statistics, but rose rapidly once shipping was restored in 1997. The likely explanation for the official mis-recording is that the cocoa was being bought directly by Rabaul-based buyers and may have been misattributed as East New Britain cocoa.<sup>27</sup>

By that time too, the UNDP Bougainville Cocoa and Coconut Rehabilitation Project (BCCRP) and the AusAID BCCDRP had begun to assist rehabilitation of plantations and dryers. Average post-crisis annual production from 2001 to 2006 has been just over 11,200 tonnes, or 264 percent of the average annual production recorded during the

crisis. Significantly, the 2004/05 output of 15,670 tonnes has already matched the pre-crisis annual production average of 15,600 tonnes.

### *Difficulties with official data*

As cocoa is the dominant export crop in Bougainville, impact distribution of SMC-based economic recovery is largely determined by per capita levels of cocoa production in each locality. District level data is available, but is unreliable for reasons outlined below. Therefore, new estimates for the present study are derived from multiple sources.

Cocoa production data for Bougainville is obtained from cocoa buyer shipment records and from cocoa buyer's 'bounty book' receipts, which are both collected by the Cocoa Board of PNG. In each case, both provenance data (where the cocoa was produced) and quantity (in bags or tonnes) is collected. Both data sets are unreliable, as is evident in the variability between the different sets of data. This unreliability is acknowledged by Cocoa Board officials involved in compiling the data.

### *Breakdown in regulation*

The difficulty of developing reliable production statistics for Bougainville has resulted from trader non-compliance with industry regulation. This has led to the emergence of what we coin here as 'black-market' and 'grey-market' cocoa. Normally cocoa is produced in a fermentary that has been registered and given a license number by the Cocoa Board. This number is stencilled onto every bag of dry cocoa produced and then sold to the exporter. The purchase is receipted and Cocoa Board receives a copy of this 'bounty book' receipt, which is used for tax purposes and to compile district-by-district production data. However, when a local dealer buys cocoa from an unregistered fermentary, brands it with the number of a registered fermentary and sells it on to a cocoa exporter it is referred here as "grey-market" cocoa. Black-market cocoa is unbranded and unreceipted and eventually mixed with legitimate produce for export.

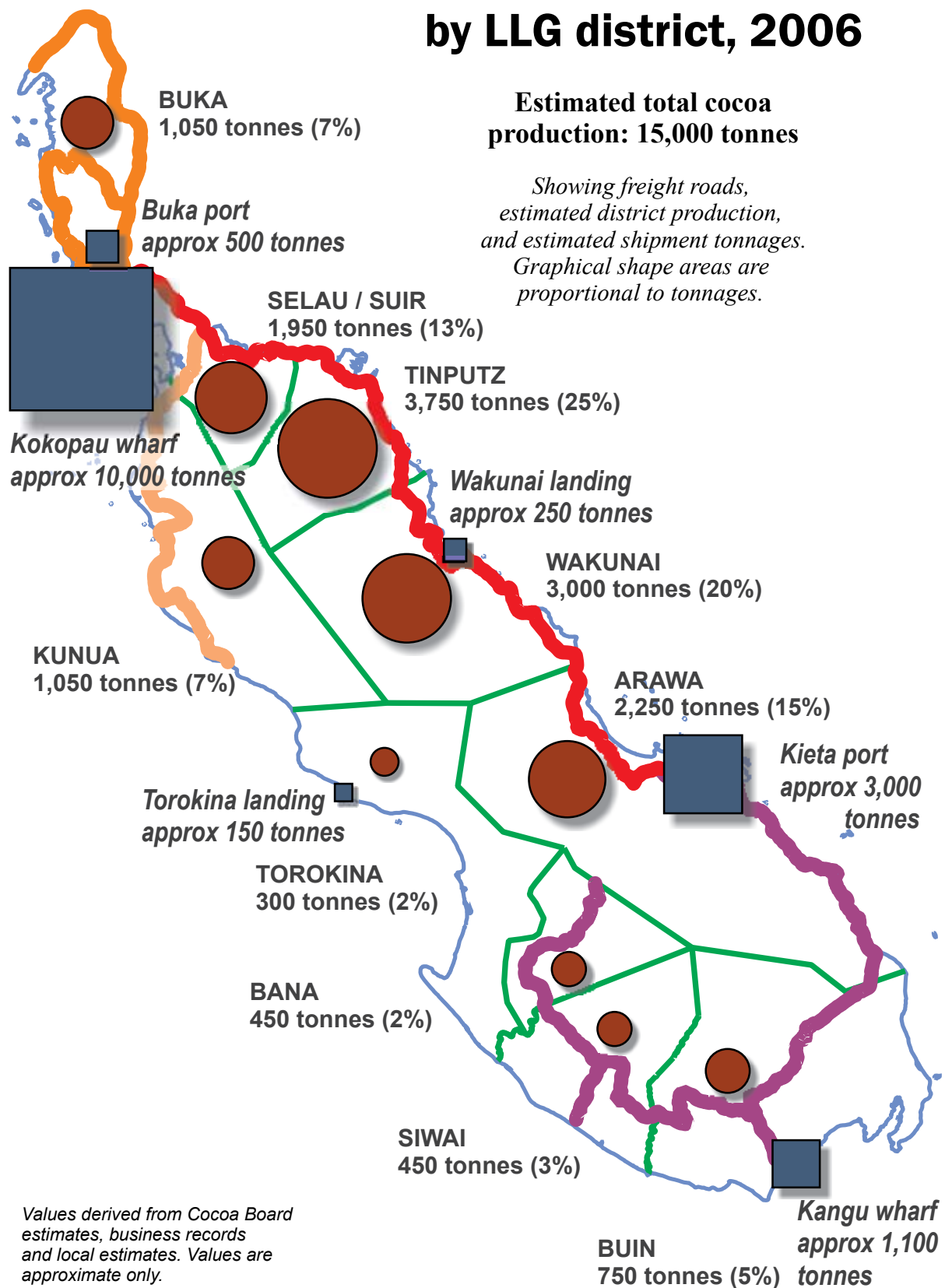
The emergence of the cocoa grey and black markets in Bougainville relates in part to a breakdown in fermentary licensing and partly to industry deregulation. After the crisis, the number of fermentaries in Bougainville has risen to many hundreds largely due to

**Table 2. Bougainville cocoa shipments (tonnes) 2005-06, from dealer records**

Month	Buin shipmts (1)	Kieta shipmts (2)	Garamut Kokopau (3)	Outspan Kokopau (4)	Outspan Buka (5)	Agmark Kokopau (6)	Total tonnes
Oct-05	72	263	54	14	14.0	249.3	666
Nov-05	56	129	54	32	14.0	282.8	568
Dec-05	55	149	10	68	14.0	479.8	776
Jan-06	9	215	47	69	14.9	404.4	759
Feb-06	10	154	32	32	9.8	164.4	402
Mar-06	31	132	31	51	26.7	201.1	473
Apr-06	91	165	41	40	30.0	215.5	583
May-06	199	110	216	143	31.0	702.3	1,401
Jun-06	155	200	129	187	56.0	1,394.4	2,121
Jul-06	229	563	183	61	8.6	794.8	1,839
Aug-06	131	342	96	58	13.8	1,270.8	1,912
Sep-06	69	160	60	119	40.2	806.5	1,255
TOTAL	1,107	2,582	953	874	273	6,966	12,755

(Sources: 1: DPI (Buin Office) data via Cocoa Board; 2: Harbours Board Kieta data via Cocoa Board; 3: Garamut Kokopau via Cocoa Board (note missing data for Oct-05 estimated from following month's value); 4: Outspan Kokopau via Cocoa Board; 5: Outspan Buka data supplied to IMPASS (note missing data for Oct-05, Nov-05, Dec-05 estimated from Jan-06 data); 6: Agmark Kokopau supplied to IMPASS.)

# Cocoa production estimates by LLG district, 2006



**Figure 11. Map of estimated cocoa production by LLG district for 2006**

the BCCDRP. However, many of the BCCDRP mini-dryers were not registered before delivery and since then many fermentary owners have avoided registering and paying the annual fee, with Cocoa Board lacking capacity to pursue them. Data presented in Table 21 in Section 3.4.3 shows that BCCDRP distributed or rehabilitated 2,751 cocoa dryers on the mainland and Buka, but there are probably more dryers operating than this. Cocoa Board has registration records for just 1,539 fermentaries, or 56 percent of those known to exist. Current registration of many of these fermentaries has lapsed.<sup>28</sup>

Concurrently in about 2003, many new dealer licences were issued in addition to those held by the big buyer-exporters such as Agmark Pacific, Outspan and Garamut. This deregulation has created a swarm of small dealers, a number of whom are operating without licence.<sup>29</sup> In addition to licensed dealers who appear to be laundering cocoa from unregistered fermentaries through registered fermentaries, these unlicensed ‘cowboy’ dealers are most likely to be involved in black market cocoa production as they cannot declare receipts to the Cocoa Board.

### *Annual production estimate*

Undeclared cocoa is estimated to range between 5 and 10 percent of total Bougainville production and has the effect of lowering estimates of actual yield from Bougainville. To arrive at a closer assessment of cocoa production in Bougainville, an overall tonnage for calendar year 2005/06 is derived from different sources (rather than simply accepted from official data). Data collected by both Cocoa Board and by the present study for the 2005/06 cocoa year are presented in Table 2. This is based on dealer’s figures for tonnes shipped to Rabaul. To the final value of 12,755 tonnes, ten percent may be added to cover undeclared shipments, bringing the annual estimated cocoa produced in Bougainville 2005-06 to about 14,000 tonnes. Note that 46 percent of cocoa was shipped in the peak flush months of June, July and August.

### *Share of production by district*

The fiddling or absence of bounty book receipts distorts the available data for cocoa production by district. This is likely to distort estimates of the relative economic performance of each district. Cocoa Board defines three cocoa districts for Bougainville, following the national government constituency areas. North includes Buka, Kunua,

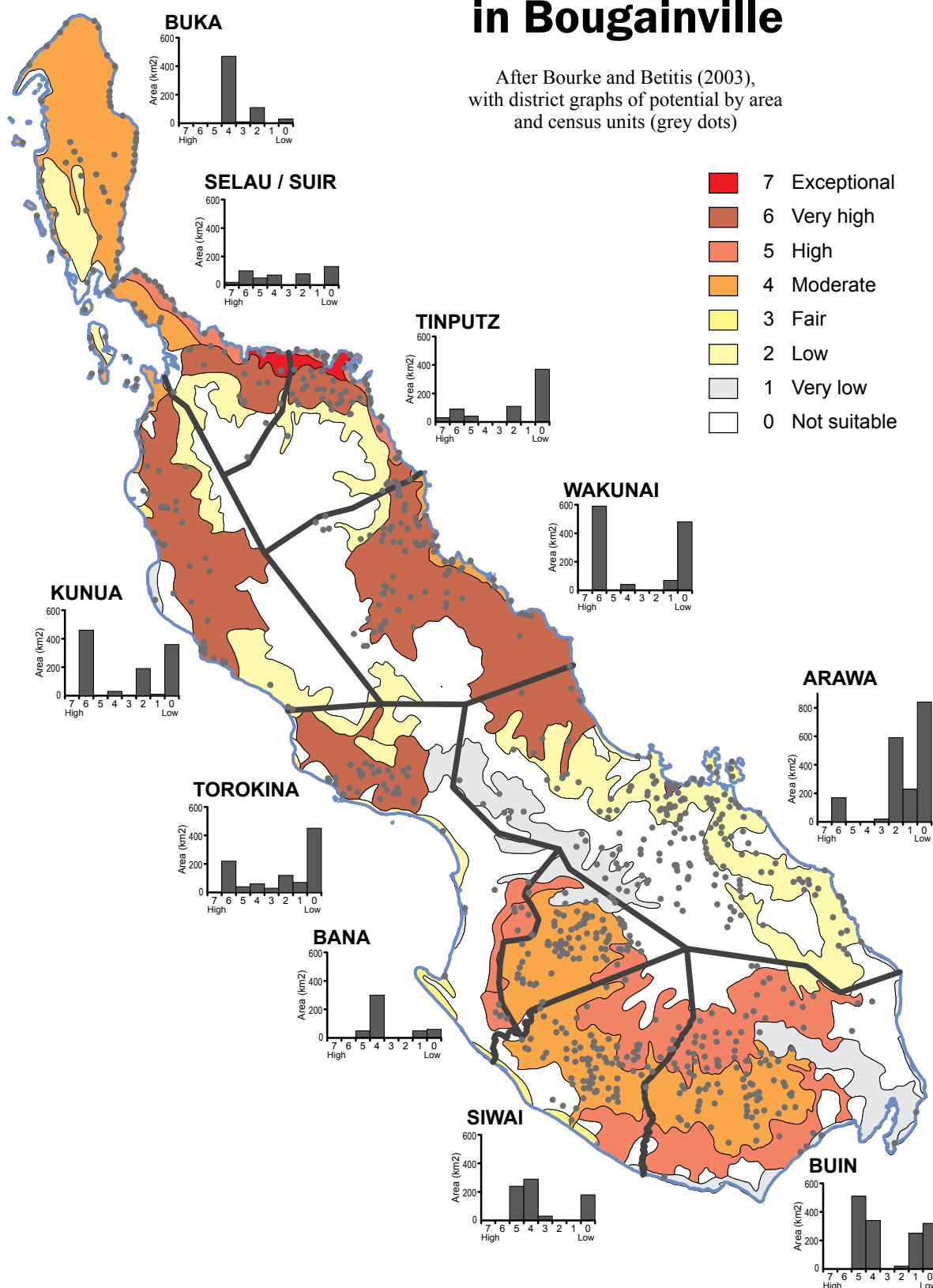
**Table 3. Percentage share of cocoa production by district, from various sources**

LLG District	Bounty Book 2005	Bounty Book 2006	COCPROD AUG06	IMPASS Estimate
Buka LLG	9.0	17.2	6.7	7
Selau/Suir LLG	8.9	16.7	13.6	13
Tinputz LLG	8.8	30.8	27.3	25
Wakunai LLG	12.5	8.7	13.6	20
Arawa LLG	36.6	23.5	23.2	15
Buin LLG	16.5	2.0	4.4	5
Siwai LLG	2.3	0.5	1.7	3
Bana LLG	2.7	0.1	2.6	3
Torokina LLG	1.7	0.2	0.0	2
Kunua LLG	1.1	0.3	6.7	7
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100</b>



# Production potential for cocoa in Bougainville

After Bourke and Betitis (2003),  
with district graphs of potential by area  
and census units (grey dots)



**Figure 12. Cocoa production potential by LLG district**

Selau/Suir and Tinputz. Central includes Wakunai and Kieta. South includes Buin, Siwai, Bana and Torokina.

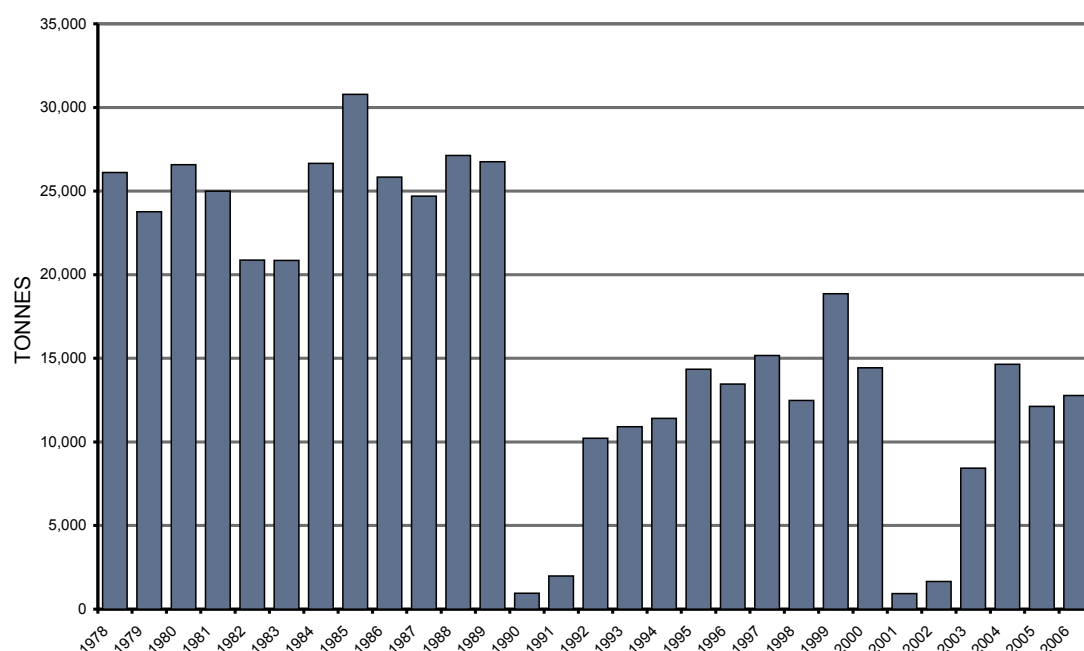
Estimates of recent cocoa production at district level may be derived from three sources, none of which is wholly reliable: 1) 2005 and 2006 bounty book data, 2) incomplete 2005-06 Cocoa Board records and 3) official 2004-05 Cocoa Board records. These can be considered together to estimate proportion of production from each district. This proportional estimate overcomes the difficulty of assessing tonnage from data that is presented variously by calendar year or cocoa year (01 October to 30 September).<sup>30</sup>

Table 3 shows production share by LLG district from these sources compared side by side.<sup>31</sup> When these are averaged and grouped by cocoa district, the proportions are: north 49%, central 39%, south 12%. The bounty books seem to overestimate production from the LLG districts that have buying points (Buka and Arawa). These probably 'capture' production from the surrounding districts and so their production tonnages are inflated; conversely lower tonnages are recorded for Selau/Suir and Kunua (some cocoa counted in Buka), and Wakunai, Buin, Siwai and Bana (counted in Arawa). The new LLG district estimates offered in Table 3 adjusts this. If grouped by cocoa district, the new estimates are: north about 52%, central about 35% and south about 13%. In any case, given the high population in the south, production there is very low in per capita terms. These estimates have also been regrouped by economic region and are shown in Table 1.

Figure 11 shows estimated production for each district using the above percentage estimates assuming an actual yield of 15,000 tonnes for calendar year 2006. The map also estimates cocoa shipment tonnages from ports, wharves and landings, based on data from Tables 2 and 3 and field interviews. Apart from cocoa shipped by canoe from Kunua and Torokina to Buka Passage, almost all cocoa is moved along the rehabilitated trunk roads.

It is worth considering the map of cocoa yield potential published in Bourke and Betitis (2003, and previously by Hanson *et al* 1998) (Figure 12). Land units (areas sharing similar physical characteristics) were ranked one to eight for suitability to cocoa production, with ratings assigned in reference to altitude, slope, rainfall and soil for each land unit.<sup>32</sup> If this mapping is reanalysed by LLG district, and the rankings multiplied by a factor of yield, it may be possible to estimate the approximate proportion of yield that could be expected from each LLG district. Such an analysis is presented in Annex 2. The calculated shares of yield do not nearly resemble the shares of actual production, either for the period around 2004-06 or that of 1978-80. The reasons may be both that population is not evenly spread in accordance with potential yield, even though to some extent it is correlated with cocoa potential, or that there are factors in cocoa yield (such as uneven distribution of crop diseases) that were not factored into the Hanson *et al* ratings. The discrepancy for southern Bougainville is significant and reduces the utility of the Hanson *et al* ratings.

There is no reliable data to indicate the extent of cocoa cultivation among Bougainville's population. Data presented in Section 3.4.2 suggests that in 1999 viable cocoa tree stock in Bougainville (not including Nissan) stood at 10.7 million. To that, the UNDP BCCRP distributed at least 17.6 million seeds and seedlings. If we assume 85 percent of the 1999 stock is still productive, and 85 percent of known BCCRP seeds and seedlings survived, then currently there might be 24 million cocoa trees in Bougainville. The average number of trees a smallholder owns is unknown. However, 720 trees (one hectare) is the standard plot although smallholdings can range up to 40ha in area. If a decay curve distribution is assumed then the average holding is about 1,000 trees corresponding to about 24,000 smallholders in Bougainville. If each smallholding is



**Figure 13. Bougainville annual copra production 1979-2006**

regarded as one household and there are about 35,000 households in Bougainville (not including Nissan/Atolls) in 2007, then about 68 percent of Bougainville's households grow cocoa. The 2000 census reported that 74 percent of Bougainville (not including Nissan/Atolls) households grew cocoa. We may infer that more than two-thirds of Bougainville households grow cocoa. This explains the general association between census unit distribution and areas of better cocoa potential as shown in Figure 12.

### 3.1.4 Copra Production

Copra, the oily dried endosperm of the coconut, is Bougainville's second largest agricultural export. It is mainly used for food oils and making soap. Coconut trees are used as a tall shade canopy over cocoa in many parts of Bougainville. However, only a fraction of these are harvested for copra. Production in Bougainville from 1978 to 2006 is shown in Figure 13. Data from 2003 onwards is based on the figures in Table 4.<sup>33</sup> Copra production was disrupted between 2001 and 2003 by changes to marketing arrangements.

Official production data for Bougainville in recent years is inconsistent with data from other sources. Data from Coconut Products Limited Buka bills of lading and from Makerio Stevedores for containerised shipments together provide tonnages inconsistent with those from Kokonas Industri Koporesen (KIK).<sup>34</sup> The reason for this is unknown, so annual estimates for 2004-06 provided here are based on the last column of Table 4, which takes the highest figure, either KIK's figure or the sum of CPL and known containerised shipments from Buka. Since data for tonnage shipment from Kieta is unknown, this more generous estimate may go toward approximating the Kieta tonnages.<sup>35</sup>

Grower-level data from CPL showed that most of CPL's copra comes from Buka Island where it is an important crop for many farmers. A lesser quantity comes from Kunua and Selau/Suir. These three districts, along with some minor production in Arawa, appear to be the only copra producing districts in Bougainville. A rough estimate of the production

share between the economic regions is shown in Table 1. The situation differs from the pre-crisis period where ECL (1982) data showed smallholder copra production to be more widespread. Figure 9 indicates that whereas in 2000, copra obtained a price per tonne somewhat comparable to that for cocoa, copra prices remained steady while cocoa prices have increased dramatically. The high price now obtained for cocoa is inducing farmers to switch to cocoa wherever possible and is probably a major reason for the stagnation of copra production.

### 3.1.5 Underdevelopment in the south

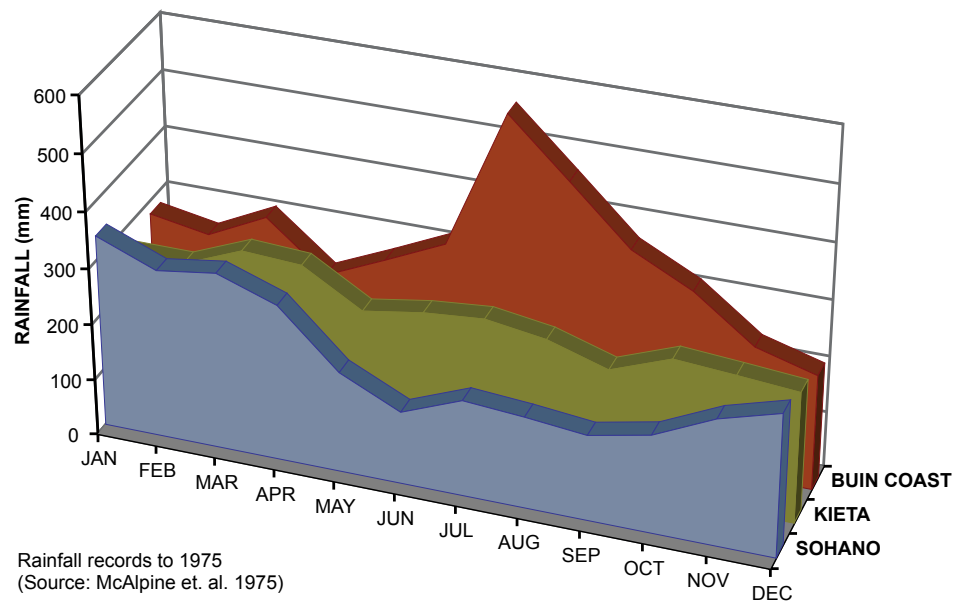
The south of Bougainville, encompassing Arawa, Buin, Siwai, and Bana districts, does not enjoy the more buoyant economic climate found in the northeast and Buka regions.<sup>36</sup> The southern districts suffer from a complex set of problems that may be summed up as consisting of high population, poor agricultural prospects and the reign of militant groups. The crisis affected the south more intensely and over a longer period than it did the north, delaying recovery. Bougainville displays a ‘developed north – underdeveloped south’ characteristic suggesting an intractable long-term policy problem for the ABG and those assisting it.

#### *High population*

Population mapping in Figure 7 shows a boomerang-shaped arc of very high population extending from Arawa through the Panguna mountains down to Bana, sweeping around through Siwai and into Buin. This arc comprises about 50 percent of the total Bougainville population.<sup>37</sup> For this southern population to achieve income parity with the north, it would need to generate about half the island’s income. Based on data summarised in Table 1, our estimate of the south’s income as a proportion of total island income is about 25 percent at present and, gross per-capita income from agricultural export is the lowest in Bougainville. Note that income from the other major source i.e. government salaries is assumed as fairly constant in per capita terms across the districts (with the exception of the capital, Buka), while private sector employment is assumed to correlate to district export crop income. The urban centre of Arawa may generate further

**Table 4. Quarterly production of copra (tonnes), Bougainville 2003-06**

Quarter	KIK tonnage	CPL tonnage	Containerised	Highest tonnage
Q1/03	3,131	-	-	3,131
Q2/03	523	-	-	523
Q3/03	85	-	-	85
Q4/03	123	-	-	123
Q1/04	4,287	3,743	-	4,287
Q2/04	4,214	3,989	-	4,214
Q3/04	2,678	2,888	-	2,888
Q4/04	3,052	2,854	-	3,052
Q1/05	1,980	1,866	1,522	3,388
Q2/05	4,180	3,749	-	4,180
Q3/05	2,044	2,589	-	2,589
Q4/05	1,957	1,893	-	1,957
Q1/06	3,573	3,477	-	3,573
Q2/06	2,681	2,506	300	2,806
Q3/06	2,617	1,958	196	2,617
Q4/06	3,556	3,467	314	3,781



**Figure 14. Average monthly rainfall, Bougainville (records to 1975)**

non-agricultural income for the south but is not expected to alter the overall pattern significantly.

Related to population is the problem of youth bulge in the south. The generation that is now reaching its early twenties has missed most or all of its schooling due to the crisis, particularly in the south. It has also witnessed years of extreme violence. Illiteracy, low vocational skill levels, mistrust of government process and trauma-based violence is characteristic of this lost generation. Theory of youth bulges suggests that these features, combined with poor economic prospects, ensure that young men will remain a volatile element in southern Bougainville.

A further demographic element, discussed more fully in Section 3.2.4, is out-migration from the south by people seeking better security and economic opportunities in the north.

#### *Poor agricultural prospects*

Excluding the south, cocoa is the mainstay of the economy in Bougainville. Cocoa potential mapping in Figure 12 indicates two bands of ‘high’ cocoa potential in the south. These prospective areas are reported by locals not to be yielding cocoa at pre-crisis levels because of excessive rainfall. High rainfall causes flowers to fall and increases the incidence of drainage-related tree disease. Figure 14 illustrates the rainfall pattern in Bougainville by comparing Sohano in the north, Kieta in central and Buin coast in the south.<sup>38</sup> Although each location experiences a March rainfall averaging just above 300 mm, rainfall peaks sharply midyear in the south of Bougainville, whereas it dips midyear in the north of Bougainville and remains more or less constant in the central districts. Local informants think the midyear peak affects flowering more now than it did pre-crisis, possibly because the peak has shifted further into the flowering season. There is no recent rainfall data to confirm this.

At present, cocoa yields from the ‘deep south’ (Bana, Siwai and Buin LLG areas combined) are just 8 percent or so of total Bougainville yield (Figure 11). Unless this is corrected the prospect for cocoa as a mainstay crop in the south is poor even if better agricultural services are provided. Agricultural recovery in the south may need to be predicated on a crop or mix of crops not previously widespread in Bougainville. This



**Sign of a fragile state: Me'ekamui no-go zone, Panguna**

will raise problems associated with the lack of established market chains, low farming knowledge and new lifestyle routines around the new crop.<sup>39</sup>

#### *Instability and lawlessness*

Following the withdrawal of the Peace Monitoring Group in June 2003 and the Bougainville Transition Team in December 2003, peace deteriorated in southern Bougainville during 2004. Arguably, peacekeepers were withdrawn too early from the south. With the failure of agriculture and a lack of employment prospects in the south, unemployed male youths in these densely populated districts are attracted to bandit activity reinforced by a 'Rambo' mindset that emerged during the crisis years. Crisis-period small arms are prevalent in the south in the hands of militant factions that are in a state of continuing tension. Efforts to tackle these problems have been in stalemate. The clearest indication of this impasse is the ongoing 'no-go' area around Panguna, with the warning to officials not to visit Buin, Siwai and Bana. Reconciliation attempts between opposing armed gangs have failed and individuals accused of post-conflict crime including serial murder and gang rapes have not been arrested. The prevailing banditry continues to prevent investment and access for government service delivery in the south.

The study now considers the impact of each of the AAB projects.

## **3.2 Impact of trunk road rehabilitation and maintenance**

The trunk road is considered first. Project descriptions for BCTRRP and BCTRMP were covered in Sections 2.1 and 2.2. The effectiveness of the road projects in providing a smallholder market chain (SMC) linkage is evaluated, as is a range of associated topics, as follows:

- transport economy, including improvement of transport services,
- effect of the road on access to health and education services,
- changes to the spatial economy of Bougainville due partly to the road and internal migration brought about by these changes,
- development of the road construction and maintenance industry,



- feeder roads are examined because of their role in establishing smallholder market chain linkages, although they were not a part of the AAB road projects,
- impacts of the road on poverty and gender, environment, HIV/AIDS transmission and contribution of the projects to peace-building are dealt with in Section 3.5.

### 3.2.1 Transport economy

The Bougainville coastal trunk road, both on the mainland and in Buka, existed pre-crisis as the major vehicular route. Rehabilitation has mostly been of the pre-crisis roadway, although some minor realignment has been undertaken. The rehabilitation of the trunk road has facilitated vehicular movement of people and freight along the road, lowering time and cost and increasing distances travelled. It has seen the rise of a Public Motor Vehicle (PMV) industry along the length of the road. Traffic volume, PMV traffic and freight are now discussed in turn.

#### *Traffic volume*

The coastal trunk road rehabilitation has increased the amount of traffic moving between major destinations in Bougainville. While no numerical data is available for the immediate post-crisis period, all informants confirm that road traffic was minimal due to road conditions ranging between poor and impassable.<sup>40</sup> Today the road consists of a 6m wide all-weather paveway typically surfaced with unprocessed river gravel with coronous limestone used predominantly in northern Bougainville and Buka. In some sections crusher gravel is used.<sup>41</sup> The road is now in generally good trafficable condition with the exception of the wet crossings (see Figure 6). Many in Bougainville want to see bridges replace the wet crossings.

Road traffic counts were taken in three locations: Itakara junction (north of Arawa) town, Siara junction (south of Kokopau), and Lonahan junction (north of Buka) during mid-December 2006. These junctions were chosen as they allowed a traffic count from two sources converging on the major centres of Buka/Kokopau and Arawa. The locations were sufficiently distant from town boundaries to be unaffected by local town traffic (Refer to Figure 6 for locations).<sup>42</sup> Summarised data, averaged across two days in each location, is presented in Tables 5 and 6 (Annex 3 provides full data). Note that the count at Itakara Junction does not include a known daily traffic of about 10 to 15 PMVs bound for Kokopau that pass by at about 4am. The data cannot be considered statistically significant as counting was carried out on only two days and the level of variation is unknown. The following findings are therefore subject to these limitations.

Table 5 shows that around 200 vehicles pass daily at Siara junction along the Kokopau-Arawa road. Not all of this moves to and from Arawa; an unknown but large amount of this goes only to and from Tinputz and Wakunai. About 200 vehicles also pass by Lonahan junction along the Buka East Coast Road, between Buka town and the large

**Table 5. Average number of vehicles at different times of day**

LOCATION AND ROUTE	6am to 10am	10am to 2pm	2pm to 6pm	TOTAL VEHICLES
Lonahan Jcn: Buka - Gagan Road	35	13	33	81
Lonahan Jcn: Buka - Lontis Road	79	36	78	192
Siara Jcn: Kokopau - Kunua Road	14	7	15	35
Siara Jcn: Kokopau - Arawa Road	78	65	58	201
Itakara Jcn: Arawa - Bana Road	13	30	38	81
Itakara Jcn: Arawa - Kokopau Road	33	13	29	75



**Mainland PMVs at the Kokopau terminus; 3-tonne PMV in Buka town**

coastal villages to the north of Lonahan.<sup>43</sup> Fewer than 100 vehicles were recorded at the three locations travelling to and from other destinations. Apart from the relatively busy Buka East Coast road and the northern end of the Kokopau-Arawa road, most other roads have low traffic density.

Table 6 shows the average number of vehicles recorded under each category of vehicle. Heavy trucks (4 or more axles) and semi-trailers found in mainland PNG are not present in Bougainville. Some medium (3 axle) trucks such as 4m<sup>3</sup> tippers are used in road construction, and a few of these have been recorded on the move. Two-axle trucks such as the common Isuzu 3-tonners are used either for freight, or especially in Buka and the northern tip of the mainland, as large PMVs and so span the 'bus' and 'light truck' categories. Buses ply in Buka only and large PMVs (3 tonne trucks used as PMVs) are rarely seen except in Buka and the north tip of the mainland. In the remainder of the mainland, the large distances and rough roads favour Landcruiser-type vehicles, which are heavily represented under the category 'Utilities/small pick-ups/small PMVs'. There are few cars in Bougainville outside the town limits of Buka and Arawa. Typically, mainland traffic consists of Landcruisers as PMVs and a lesser number of 3-tonne trucks used for haulage; while in Buka 3-tonne trucks used as PMVs and haulage predominate, with Landcruisers occupying second place.

### *Public Motor Vehicle traffic*

A Public Motor Vehicle (PMV) is a privately operated passenger vehicle whose owner or operator charges a fare for travel. The PMVs usually travel on set routes to a locally known schedule. In mainland Bougainville, the Landcruiser-type PMVs are often recognisable by the flamboyant sign writing and whimsical names advertising their route. The three-tonne trucks used as PMVs in Buka are more prosaic. Immediately post-crisis there were virtually no PMVs except in Buka and the north tip of the mainland. In

**Table 6. Traffic by type of vehicle**

TYPE OF VEHICLE	Cars	Ute/small PMV	Bus / Large PMV	Light truck	Medium truck	TOTAL VEHCL
Lonahan Jcnctn: Buka - Gagan Rd	5	15	61	0	1	81
Lonahan Jcnctn: Buka - Gogohe Rd	13	44	135	0	0	192
Siara Jcnctn: Kokopau - Kunua Rd	1	13	19	0	3	35
Siara Jcnctn: Kokopau - Arawa Rd	3	150	41	7	1	201
Itakara Jcnctn: Arawa - Bana Rd	4	66	0	10	2	81
Itakara Jcnctn: Arawa - Kokopau Rd	2	63	0	8	3	75

# Bougainville PMV network

Fare costs one way (Kina) to major destinations  
December 2006

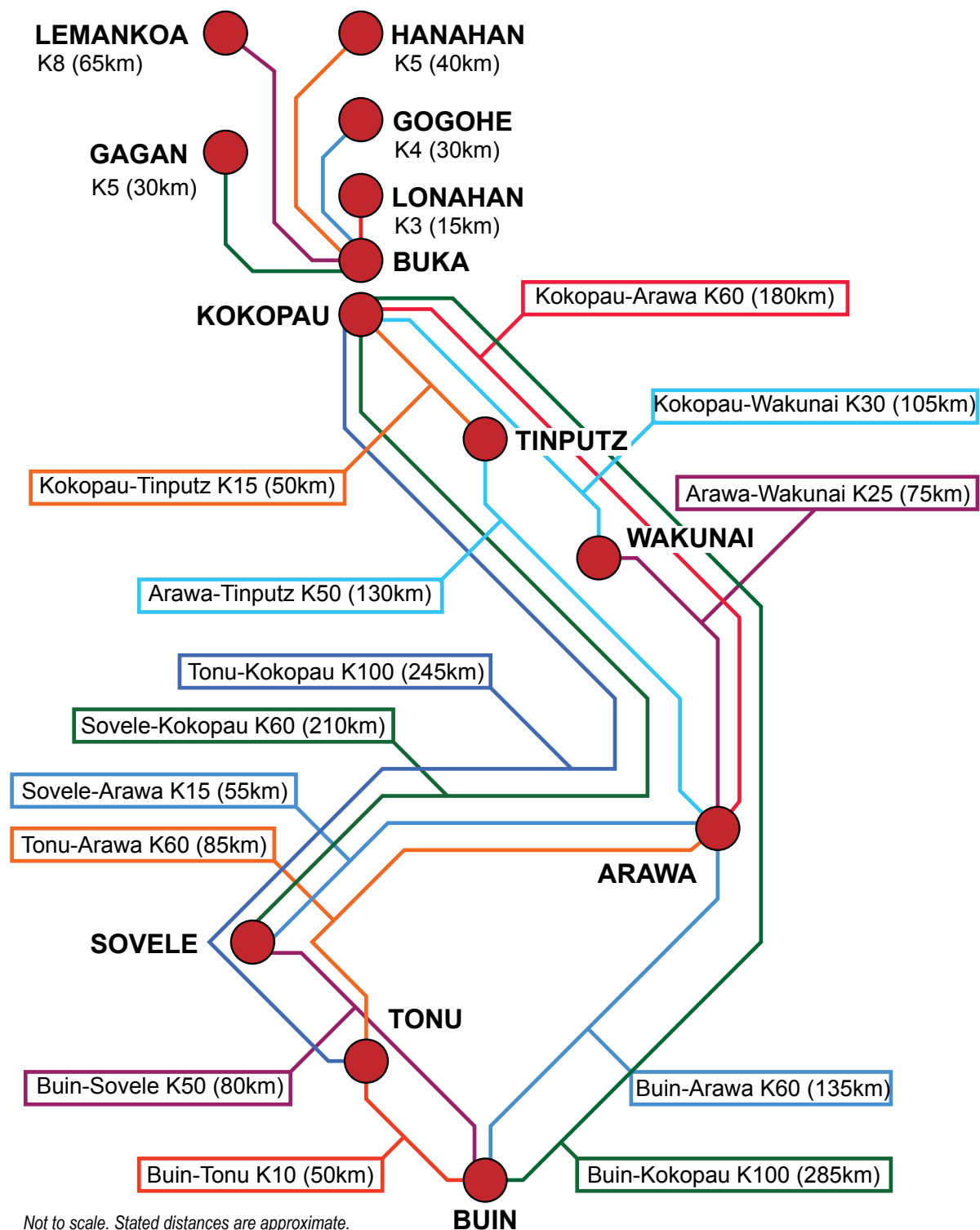


Figure 15. Schematic map of the Bougainville PMV network

**Table 7. Known PMVs operating in Bougainville by district, 2006**

District	Long haul	Short haul	Total
Buka	52	-	52
Selau/Suir	-	-	32
Tinputz	15	20	35
Wakunai	11	6	17
Arawa	15	-	15
Buin	29	34	63
Siwai	-	-	30
Bana	9	3	12
Torokina	0	0	0
Kunua	0	-	0
<b>Total</b>	<b>131</b>	<b>63</b>	<b>256</b>

December 2006, groups of local informants from Buka, the northeast and south were asked to list all PMVs in those regions. Table 7 shows the resulting count of PMVs known to be operating in late 2006. The table makes a distinction between ‘long haul’ and ‘short haul’. Short haul PMVs are often older and in poorer condition, most suited to travel from outlying areas to district centres. Long haul vehicles are generally newer and in better condition. On the mainland, they travel the long routes to Kokopau or Arawa. PMVs regularly servicing the routes to Buka town are included as ‘long haul’ because of their better condition. In some districts the number of short-haul PMVs is unknown. The table shows at least 250 PMVs in Bougainville, at least half of which service long-haul routes. PMVs typically cost between K50,000 and K200,000 to buy, depending on size and whether new or used. Most of the 130 long-haul PMVs have been bought since the crisis, and if each was bought for K50,000 this represents an investment of at least K13M. This investment is good evidence that in the environment of SMC economic recovery, PMVs have developed as a micro-enterprise opportunity.

A schematic of fare costs and distances travelled between major destinations is shown in Figure 15. The routes fall into three sections: Buka Island, Kokopau-Arawa, and the South, which conform to the economic regions discussed earlier. The west coast was said to have no PMV services at the time of the study. The busiest section of road is that between Arawa and the road-head at Kokopau, which absorbs the traffic both from the northeast region as well as the long-distance travellers coming from the south to utilise services in Buka town. Buka Island has a small, dense layout of PMV destinations focused on Buka town.

Despite its high population, the south has a sparse PMV network. The southern network is focused strongly on Arawa and weakly on Buin. In the south, there is an alternative route where vehicles ply from Bana to Arawa over the old Panguna road which is in serious disrepair. It has not been rehabilitated or maintained under the BCTRRP/ BCTRMP. In part, the Panguna route is favoured because it is a shortcut from Siwai and Bana, but also because access through the Buin-Arawa trunk road was blocked

**Table 8. Comparison of PMV fare costs according to trendline analysis**

ROAD	DISTANCE TRAVELLED (km)					
	25km	50km	75km	100km	200km	300km
Buka Road	K3	K6	K9	K12	K22	K33
Kokopau-Arawa Road	K10	K18	K26	K35	K68	K101
South Road	K16	K24	K33	K41	K76	K110

by militants in 2006. The schematic in Figure 15 is a simplified depiction based on comprehensive data collected between December 2006 and March 2007.

Data collected on PMV fare costs and distances was analysed by economic region to determine if there were large differences in the fares for similar distances travelled. This data was graphed for each section (Buka, Kokopau-Arawa and South). On each road-section graph (Annex 4), a linear trend-line was drawn through the data points (on a least-squares basis) ironing out the effect of local variations within each section. The equation derived for each trend-line was then used to model fare prices at certain distances. The results are presented in Table 8 which permits a comparison of travel cost over distance on each road section. Note that the maximum single-journey distance in Buka is just 70km (Lontis-Buka), Kokopau-Arawa is 180km and Buin-Kokopau is about 285 km; comparison beyond these limits cannot be fairly made.

A significant variation was found in transport costs between the three road sections. For example, the fare for a distance of 75km travelled in Buka would according to the model, cost K9, while along the Kokopau-Arawa road it would cost K26 and in the south, K33. The fares along the Kokopau-Arawa road are about 3 times the cost for a similar distance in Buka, while those in south are 3.6 times that in Buka. Compared with Kokopau-Arawa, costs in the south are 1.2 times higher.

On the mainland routes, passenger loads are usually full, while in Buka they are full in the morning and evening but less so during the day. Cost variation between these sections is not due to lower passenger volumes on mainland routes, but rather because of the much higher PMV overhead costs on mainland routes compared to Buka. Much of the Buka Island roads are surfaced with relatively smooth coronous gravel (with 6km sealed), has no wet crossings and distances are generally shorter. On the mainland, the road is rougher, has many wet crossings and long distances are routinely travelled. Diesel costs are higher where the roads are rough, as is the case on mainland routes. Maintenance costs (suspension, tyres and chassis fatigue) are much higher due to the high speeds reached to cover long distances along the rough unsealed roads of the mainland routes. The wet crossings on the mainland routes cause eventual ingress of water into the gearbox, differential and sump, requiring higher than normal major mechanical servicing. These costs have been even higher in the south, due to poor road conditions caused by continuing unrest. A secondary explanation for the higher costs is related to unit cost, in that the Buka routes use three-ton trucks that carry forty people, while the mainland routes use Landcruisers, which take 12 to 20 passengers.

#### *Road freight costs*

Costs were sought for road and sea freight from each district to the major centres and were quoted in kina per bag of dried cocoa. In general, freight costs can include 1)

**Table 9. Estimated average freight costs by district (Kina/bag cocoa)**

District	Buka	Selau/Suir	Tinutuz	Wakunai	Arawa	Buin	Siwai	Bana	Torokina	Kunua
Estimated average cost	15	15	20	25	10	10	25	25	100	30

cost of carrying cocoa manually from a fermentary to a feeder road, 2) transport of cocoa (manually or by vehicle) along a feeder road to the trunk road, or in some cases 3) limited movement along the trunk road to a local cocoa buyer. However the costs considered significant for this study were those of transporting one bag of cocoa from a pick-up point along the trunk road (typically at the mouth of a feeder road) to a major buyer (in Buka, Kokopau, Kieta or Kangu). This excluded (1-3) above.

Data was collected in most districts. There was some variation in the answers provided, usually within a range of  $\pm K5$ . Owing to discrepancies in the charges levied by carriers, different uploading locations within a district and the relatively thin statistical data to cover these factors, a non-statistical estimate was made for average freight cost from the district to a major buying point. The estimated average cost of road freight per bag of dry cocoa bean from each district to major buyers is shown in Table 9.

Cocoa freighted by road from the districts of Kunua, Selau/Suir, Tinputz and Wakunai converges on Kokopau wharf where a number of buyers, principally Agmark, Garamut and Outspan, are stationed. Although Wakunai is closer to Kieta port, cocoa is still sent to Kokopau, to obtain better prices. Theft around the insecure wharf at Kieta is a further disincentive to marketing cocoa there. Nevertheless, some cocoa finds its way from Wakunai to Kieta, back-loaded in limited quantities on vehicles going to Arawa for other reasons.

Cocoa buyers at Kieta attract growers in Arawa, Bana and to some extent Buin. Most cocoa produced in Siwai and Buin goes to Kangu wharf via the buyers in Buin. As with the produce from Wakunai, cocoa bound for Kieta from Buin is back-loaded on goods trucks. Cocoa produced in Buka Island is sold in Buka town to middlemen who then ferry much of it to major buyers in Kokopau. Local 'spot buyers' too buy cocoa along the road from the back of their trucks to sell to the major buyers. These middlemen sell their cocoa in bulk to the big buyers at prices better than those obtained by the growers, having bought cocoa at a lower price from growers who thereby avoid arranging for their own transport.

Coastal sea freight is also used, but not as much as before road rehabilitation. Agmark Pacific agents who had set themselves up in Tinputz, Wakunai and Inus just after the crisis to take landing craft shipping from the landings, have subsequently closed down as road freight has become more competitive with improved road conditions. At peak flush times Wakunai is still used by Agmark landing craft. Agmark estimates the cost per bag of cocoa shipped from each of the landings and wharves on one of their landing craft (*Huris, Pelpel, Niugini Trader*) to Rabaul to be as follows: Kokopau: K10, Wakunai: K12, Kieta: K12, Kangu: K17.

Production in Torokina is throttled by the high freight costs of freight by small outboard-motored dinghies to Buka. Transport of cocoa from Torokina by more efficient vessels is rare, although there are occasional middleman buyers such as Pemana who in 2006 made at least one cocoa-season trip in Agmark's *Pelpel* landing craft.

This overall picture of the movement of cocoa as a balance of freight costs and buyer pricing, is consistent with the overall result for cocoa shipping volumes from each port as shown in Figure 11.

Freight costs by road at an average of say K20 to K25 per bag were around 10 percent of the delivered-in-store prices obtained in Kokopau in late 2006, which were around K230 per bag. Given the poor state of the cocoa industry immediately post-crisis, the high volumes of cocoa now transported by road at a relatively low cost indicate the overall success of trunk road rehabilitation and maintenance in the economic recovery in



Bougainville. Bougainvilleans attest to this, as does the counterfactual case of Torokina, where a high cocoa potential remains unrealized because of transport disincentives.

The economic success of the trunk road has been profound. However, in the immediate post-crisis period the use of landing points at Tinputz and especially Wakunai for cocoa shipment raises the question as to whether an integrated approach to sea and road freight should have been explicitly considered during project design. As it stands, the rehabilitation of the road may have out-priced existing sea freight options, invoking sustainability concerns. Whereas road maintenance is publically funded by Australia, sea freight is financed by local business. Sea freighting at present consists primarily of cocoa shipment from Buka, Kokopau, Kieta and Kangu (see Figure 11) but was more widespread in the immediate post-conflict period.<sup>44</sup> Warehouses exist at some of these points (particularly in Kokopau) and loading facilities are satisfactory but short of optimally efficient. The road has outpriced shipping from Wakunai, although this is may be due to the poor state of this facility causing it to be uncompetitive.

Focusing on the high-production cocoa belt of the northeast mainland, at first sight it would be more optimal if the major buying point were located toward the centre of the region. While many locals and cocoa industry players think that freight costs of shipping from Tinputz wharf cannot compete with freight costs by road to Kokopau, the situation for Wakunai may be different. Investment in a hard landing, warehousing and stevedoring facilities at this presently undeveloped site may alter the balance of road freight and shipping costs, creating a more efficient transport network. In itself this may not be a priority, but it could have an effect on the sustainability of trunk road maintenance, as discussed hereunder.

As the traffic count data shows, much of Bougainville's trunk road traffic consists of small Landcruiser traffic and the relatively larger 3-ton and 7-ton haulage trucks, which are used primarily for cocoa and general goods movement. Vehicular wear and tear on road surface is generally known to increase as the square of the mass of the vehicle. That is, larger heavier vehicles damage road surface more than smaller lighter vehicles. Ideally this is offset by increasing the number of axles to spread the load over more road surface, but frequent overloading of vehicles in Bougainville increases the point load on the axles of even smaller vehicles, digging in and damaging the road. A number of people remarked on the effects of traffic on the road surface particularly after heavy rain. Even with maintenance carried out under AusAID's relatively well-funded BCTRRP, many road users think that the work done is not enough to counter the effects of vehicle damage to the road surface. If funding levels fall, this damage will impact on road use and the economy. Part of the problem is that freighting currently uses the entire road end-to end due to cocoa dealer locations at each end rather than centrally. Ideally, heavy cocoa freighting should be kept to a concentrated central point that can be maintained more frequently, leaving the rest of the road to receive lighter maintenance since it is not so prone to heavy vehicle use. This in turn may reduce maintenance costs, which prompts a closer look in future at the transport economics of wharf rehabilitation between Kokopau and Arawa.

### **3.2.2 Road usage**

The road is used for four purposes: livelihoods, community activities, governance and services access. This demonstrates the multiple role of the road, beyond SMC activity, that has been discussed in Section 1.2.2.



**Grade 3 class, Toropanos, Tinputz. Remote schools are at risk of less services**

### *Livelihoods*

Although the road is invaluable for export crop freight, and the economy, it also supports downstream business by transporting buyers and sellers to markets. While export marketing is predominantly a male activity (although the actual crop production additionally makes heavy use of female labour as well as the labour of children on the smallholder farms), domestic marketing is predominantly a female activity. The EU has restored large covered markets in Buka, Kokopau, Arawa and Buin that have proved popular. Small open air morning markets ranging from tiny village bring-and-buy activities to regular barter markets exist at various locations around Bougainville. Roadage to the covered markets is a critical part of many women's livelihoods, particularly those who can access the market at low fares. Near the towns, many people commute to town from their villages for work. This is particularly noticeable in Buka Town which attracts a large number of people from the villages along the Buka East Coast and Ring Roads.

### *Community activities*

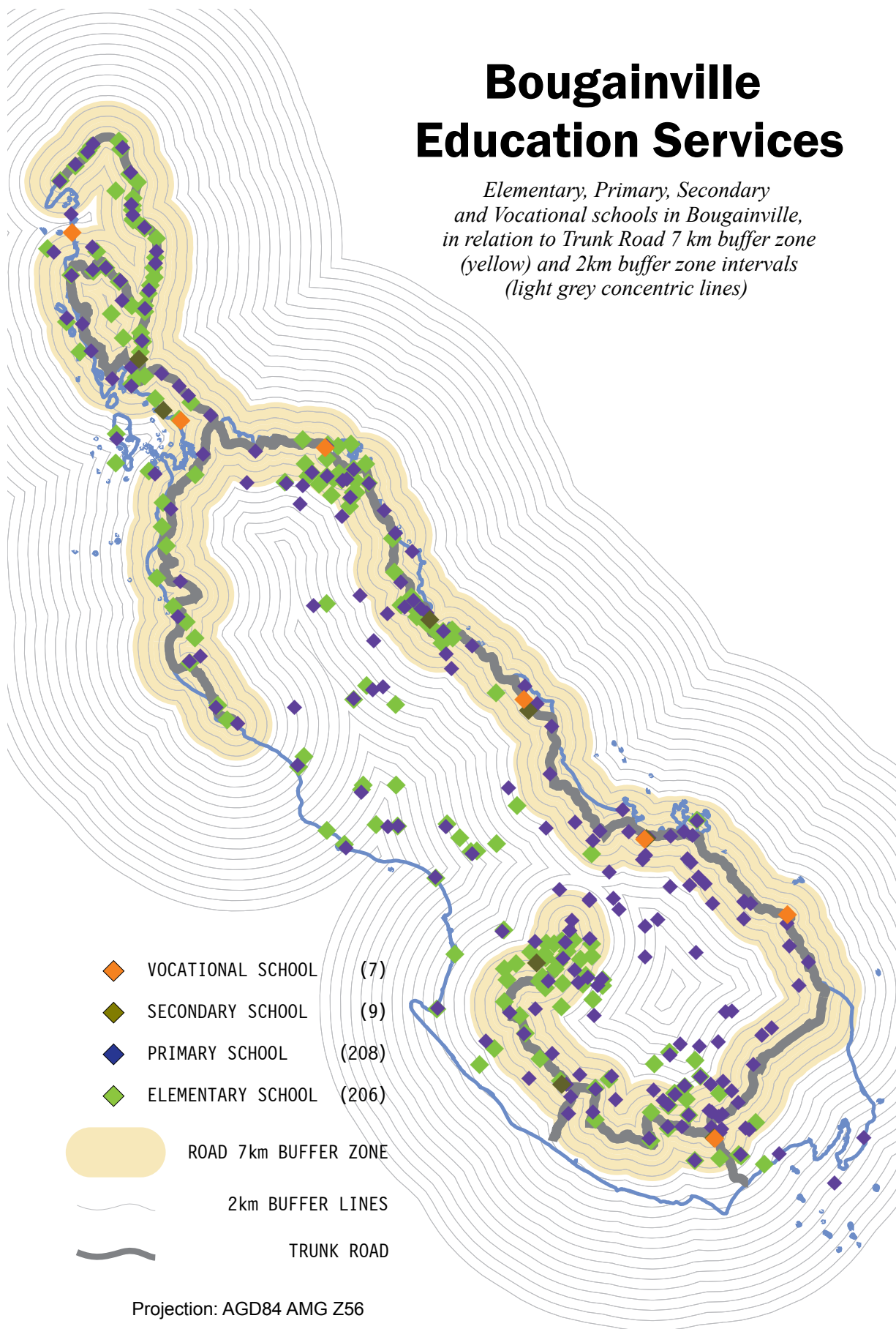
Among community activities, church attendance and attendance of church social groups is most common in Bougainville. The road facilitates travel to church and district functions such as rallies and meetings. For young people, the costs of holding district sporting events are lowered and attendances increased due to better road transport. NGOs, particularly umbrella NGOs such as the Bougainville Women's Council rely on the road to congregate for meetings and workshops.

### *Governance*

The road has improved the extension of law and order and the ability of government leaders to move between their constituencies and the government offices in Buka. Most districts possess a 4WD police vehicle, a district office 4WD, and in some cases a 4WD ambulance. However, these vehicles often cannot reach the district hinterlands because of poor condition of feeder roads.

# Bougainville Education Services

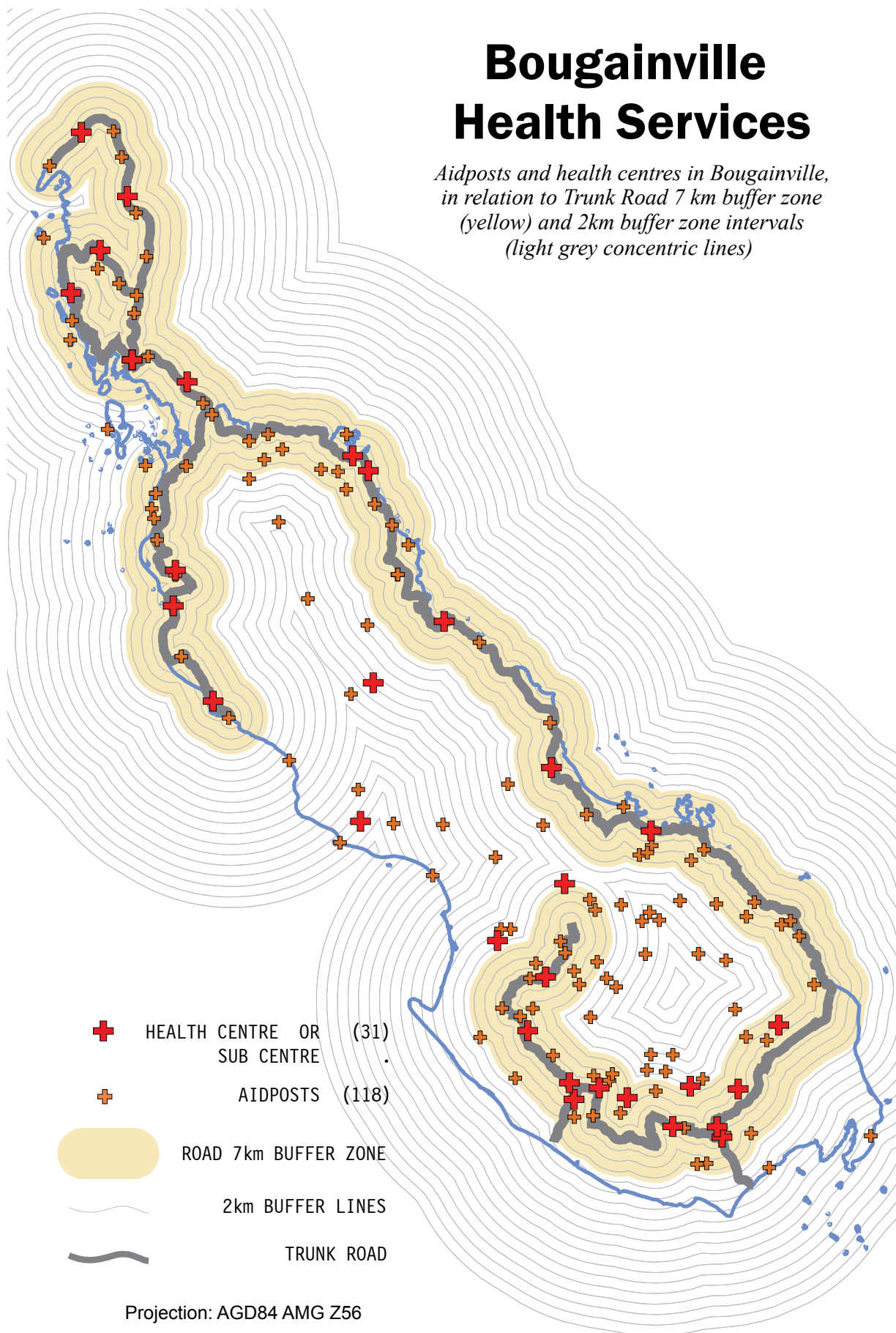
*Elementary, Primary, Secondary  
and Vocational schools in Bougainville,  
in relation to Trunk Road 7 km buffer zone  
(yellow) and 2km buffer zone intervals  
(light grey concentric lines)*



**Figure 16. Location of education facilities in relation to roads**

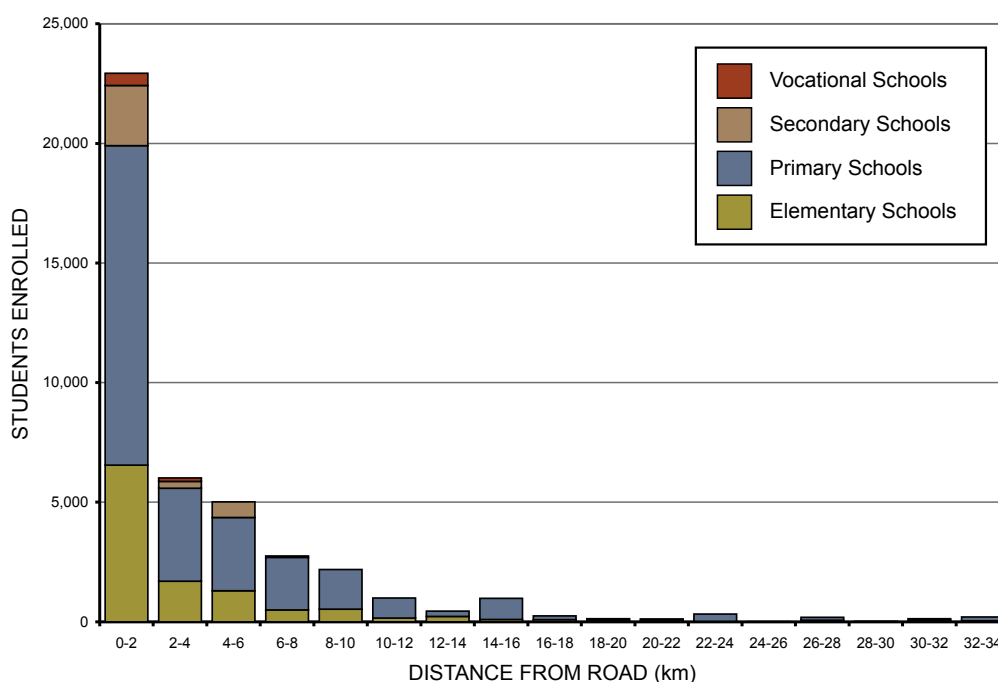
# Bougainville Health Services

*Aidposts and health centres in Bougainville,  
in relation to Trunk Road 7 km buffer zone  
(yellow) and 2km buffer zone intervals  
(light grey concentric lines)*



**Figure 17. Location of health centres and aidposts in relation to roads**





**Figure 18. Students enrolled in schools by distance from trunk road**

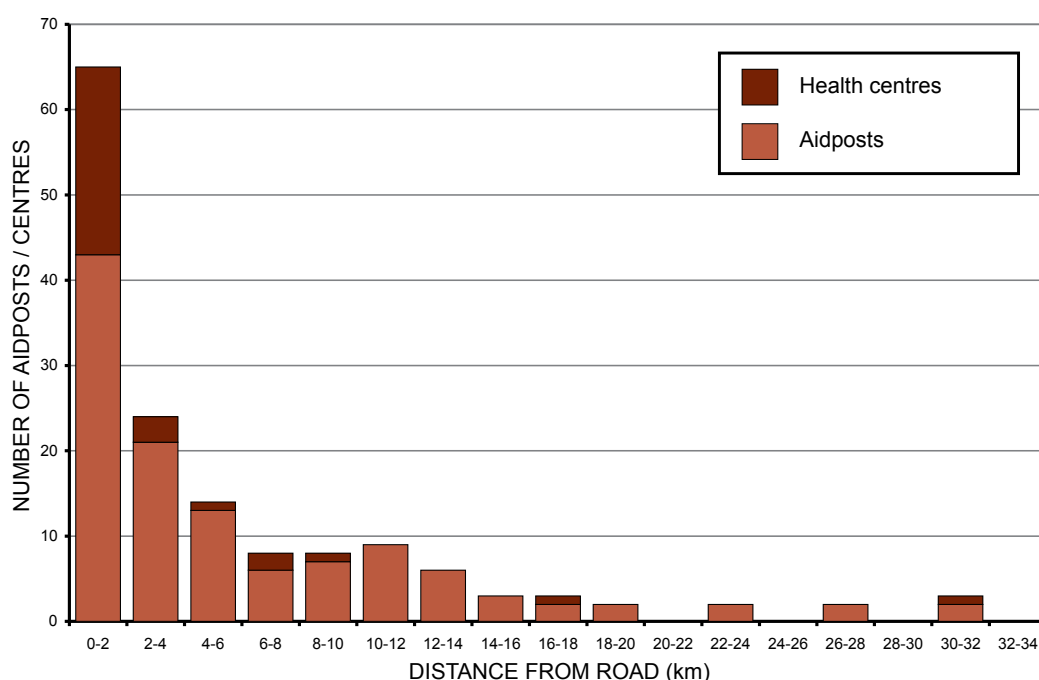
### *Services access*

Services range from local schools and clinics to banking. Every morning, all along the road hundreds of school children are seen walking to the many roadside schools and home again in the afternoon. The only bank in Bougainville is in Buka, forcing many who wish to access a bank to make the long journey to Buka. Buka also has the only hospital and the sick must make their way there from the rest of Bougainville. Services from the seat of government in Buka such as extension, and the resupply of district offices, schools and clinics, has improved with road transport. The access to education and health services is discussed in detail in the following section.

### **3.2.3 Access to health and education services**

In areas within one or two kilometres of the coastal trunk road, many people express high satisfaction with the access to services through the trunk road. The late Chief Administrator of the ABG, Mr Peter Tsiamalili, described the trunk road as ‘the bloodline of Bougainville ... everything you can think of is only possible because of the road’.<sup>45</sup> For those close to the road, cocoa can be sold to spot buyers, children can walk along the road to roadside schools, trucks of almost any condition can ferry patients to roadside aidposts and, people can take the trip to Buka for higher-order services such as banking and hospital care. Many roadside communities engage in community road maintenance contracts as fundraising activities.

At the other end of the spectrum, people who are remote from the trunk road, particularly those beyond five or six kilometres, express dissatisfaction with their ability to access services via roadways. For them, rehabilitation of the generally impassable feeder roads is high on their local political agenda. Members of these remote communities refer to the difficulty of carrying cocoa in sacks to the roadside buyers. Women set out at 2am to reach a roadside market at daybreak to sell their produce; schools still have no books and clinics are beyond the reach of the sick. Incomes and education levels are generally lower in these remote areas, while mortality is higher.<sup>46</sup> However hard data required for



**Figure 19. Number of health facilities by distance from trunk road**

comparing the quality of services between remote and near-road areas is unavailable. Local informants confirm that the condition of health and school facilities deteriorates with distance from the road.

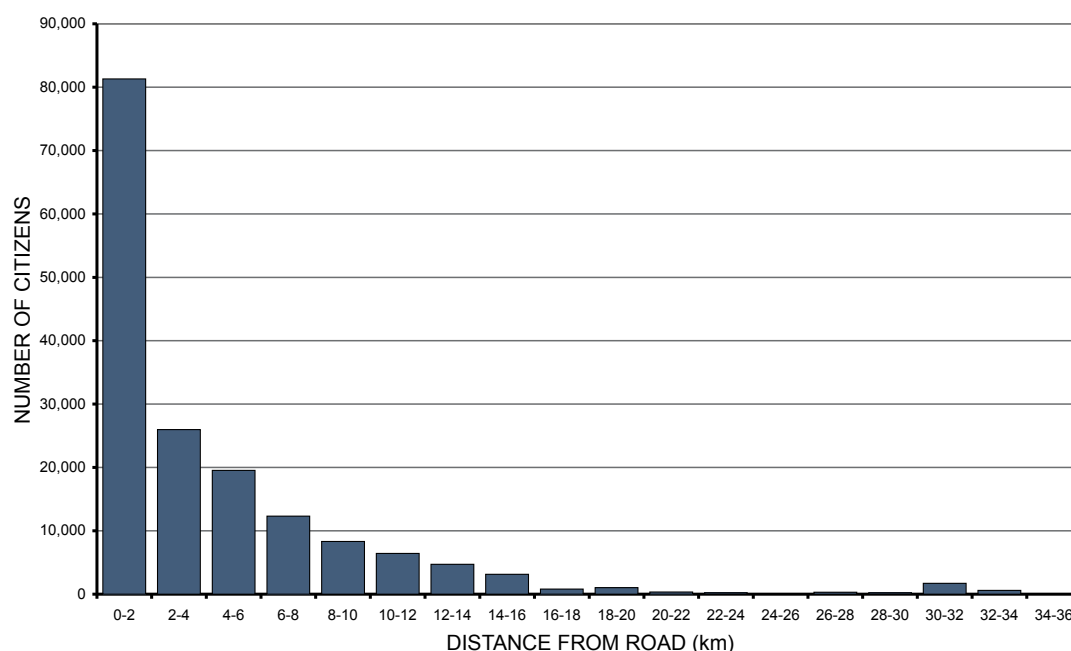
To determine the impact of the trunk road on access to health and education services, this study obtained current lists of all open schools and health facilities, and with the help of informants, mapped the location these using data not previously available (see Annex 6 for listings). The roads considered were the Buka East Coast road, Buka Ring road, Kunua road, Arawa-Kokopau road, and Arawa-Buin-Jaba River road. The BCL Panguna road was not included. Using geographic information systems software, the mapping of schools and health posts was graphically divided into categories of distance from the road by drawing buffer zones at 2 km intervals from the road (Figures 16 and 17). The number of students enrolled in schools (elementary, primary, secondary and vocational) and the number of health facilities open were then counted in each zone.

Based on the counts of students and health posts in each zone derived from the mapping in Figures 16 and 17, the proportion of enrolments and health posts at increasing distance from road was graphed. These graphs are presented in Figures 18 and 19. As is clear, most students are enrolled in schools close to the road, although there are many who are not. Some are as far as 34km from any part of the road (Torokina). The number of students enrolled tails off the further away from the road one travels. A similar pattern is observed for the number of health centres. Most are located close to the road, with the numbers thinning out as distance from the road increases.

**Table 10. Proportion of population and service delivery remote from trunk road**

	Within 1 km	1 km to 7 km	Beyond 7 km
Aidposts & Health Centres Open (%)	40	33	28
School students enrolled (%)	49	34	17
Population (%)	43	37	20





**Figure 20. Population by distance from trunk road**

A rough check can be made to test if the correlation between the decay in service distribution with an increase in the distance from the road corresponds to the distribution of population in Bougainville. Using the data from Census 2000 the total number of citizens were counted within each of the 2km interval road buffer zones. The location of the census units used for the count is shown in Figure 7 and the result is graphed in Figure 20. The results confirm that the population of Bougainville decays with the distance from the road, with density increasing closer to the road. In general then there is an approximate match between the distribution of health and education services and distribution of population, relative to the road.

Allen and Lowe (2006) cite Bouchard (1973) in observing that there is a threshold of road utility at 7 km from the road; or in effect a knee in the ‘utility by distance’ decay curve at 7km. People and services located further than 7 km from the road can be classified as ‘remote’, as the road can be expected to have little impact. Table 10 indicates the percentage of various attributes that are over 7 km from any part of the trunk road. The attributes shown are, as above, population, students enrolled and numbers of aidposts / health centres. The table shows that while many people are located very close to the road, a significant minority of about 20 percent are remote. Student numbers in these remote areas are lower as a percentage of total population. While aidposts and health centres appear to be over-represented in remote areas, they are rudimentary. Nearer the road, health facilities include many health centres and sub-centres that are larger and better equipped.

The maps in Figures 16 and 17 indicate the clusters of these remote and under-serviced populations. These include Torokina on the west coast, the mountain areas of Kieta, Buin and Bana in the south and Rotokas (upland Wakunai) in the northeast. Rotokas is serviced by the EU-rehabilitated Togerau feeder road. The other areas are cut off by poor transport linkages. In the case of Kieta, Buin and Bana, feeder roads would go a long way towards establishing better links, while Torokina requires an upgrading of its shipping services. Overall, however the trunk road provides good access to health and educational facilities for the majority of Bougainville people.



**Tractor on feeder road in Torokina; Carrying cocoa along a feeder road in Tinputz**

### **3.2.4 Spatial economy and internal migration**

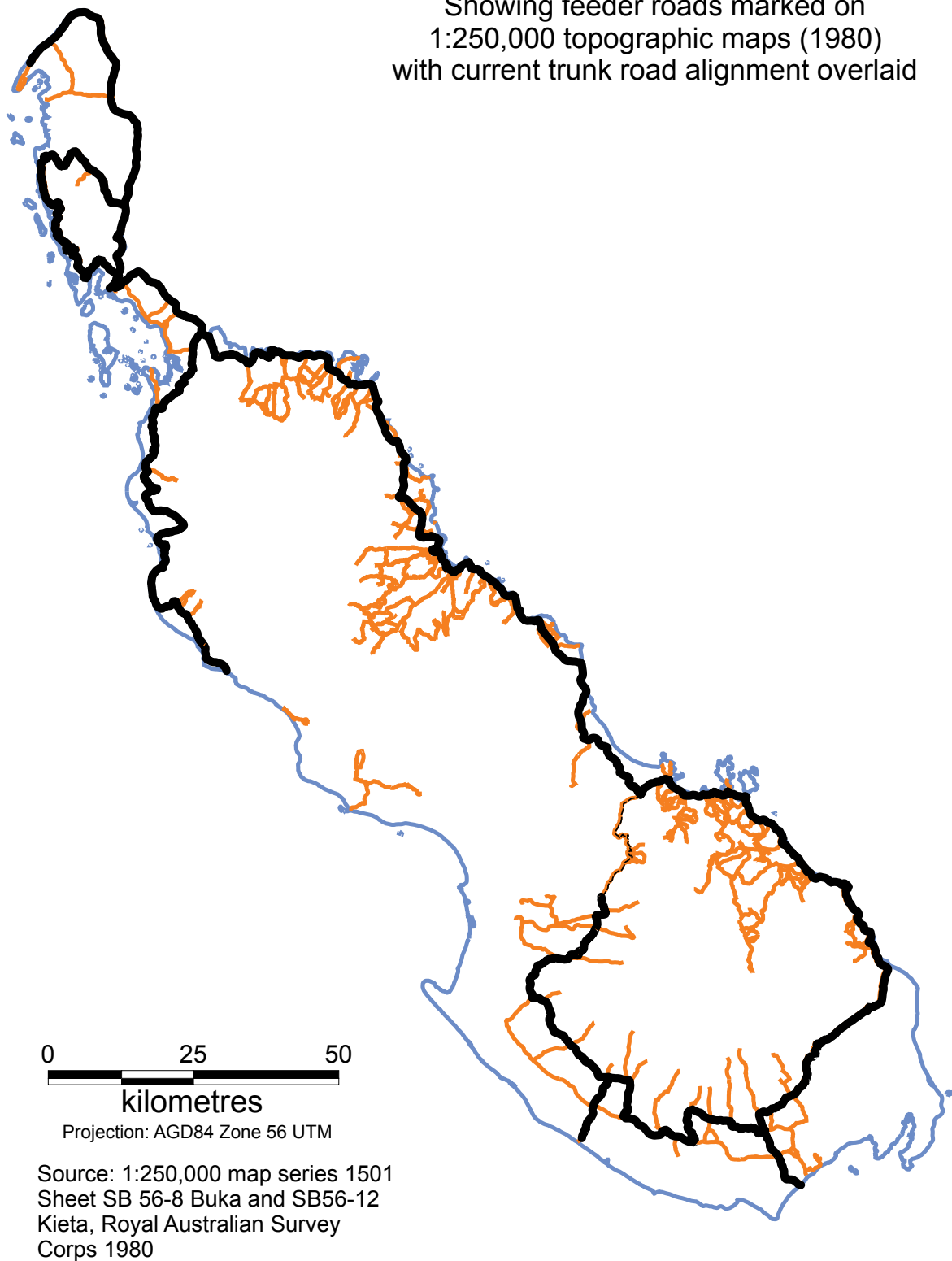
Table 1 shows that gross income per capita from agricultural export in the northeast is about K1,000, while in the south it is about K150. This can be attributed to the combined effects of uneven regional impact of smallholder market chain (SMC) assistance. As noted in Section 1.2.2, the SMC model predicts that in cases where export income is high, opportunities are created for secondary local businesses. Road access has created new opportunities in the northeast for locating secondary businesses. Combined with the disparate income levels between the south and northeast, this has created incentives for migration from the south to the north. A similar pattern is also reported in Buka. However it is notable that this push is being obstructed in each area by lack of land that can be traded to people beyond the customary landowning group.

The deepening of the economy especially along the Arawa-Kokopau road in Wakunai and Tinputz districts is encouraging the formation of central places. As noted in Section 3.1.1, central place formation is being constrained by the imposition of customary landownership. Consequently, little land is available for internal migration and settlement, or development without negotiation with the traditional landowners. This is limiting internal migration.<sup>47</sup>

In the pressure for development in the north, some people claim that land in the centres of Buka and Arawa is not available except at high landowner rent which is inhibiting growth of those urban centres. The political representatives of Wakunai suggest that their district centre should be developed commercially as the next capital of Bougainville because of its location near a large airfield in the cocoa belt. In Wakunai, a new town plan created by the Wakunai CoE for the Government district station land has provides 124 blocks, of which 13 or more are for commercial development, the rest residential. Wakunai people, they say, have priority for uptake, the rest going to public tender in Central District and the remainder to others in Bougainville. The Wakunai push has been tempered by the realisation that it is often the southerners who are commercially minded and look for opportunities, more so than the Wakunai people themselves. At the same time, there is some unease on more or less ethnic grounds about too many southerners coming into Wakunai and ‘creating problems’.

## Bougainville Feeder Roads

Showing feeder roads marked on  
1:250,000 topographic maps (1980)  
with current trunk road alignment overlaid



**Figure 21. Bougainville feeder roads (1980 mapping)**

Although the numbers are small, some concern has been expressed that the old plantation areas along the northeast section of road are being settled by people from outside the region, especially from the south. In Deos plantation there has been an attempt to manage this process, but in other plantations, there are ‘squatters’ from the south, or at least people from the south who make some financial arrangement (such as rent) with local traditional landowners. Again, ethnic mistrust is building.

District stations are best suited for central place formation, but governance arrangements for them are *ad hoc* and involve many stakeholders: ABG, LLG administration, local Councils of Elders and land claimant individuals or associations. Decision making is absent or unstable. Migrants continue to negotiate private arrangements. Lack of effective governance over the situation in combination with various claimed grievances is now causing tension between migrants and locals. The ethnic casting of internal migration from the south into the road area between Wakunai and Buka may create the conditions for ethnic conflict in the future.

### 3.2.5 Feeder roads: the missing link

Although not a part of AusAID’s scope for transport infrastructure assistance, feeder road rehabilitation is often mentioned in Bougainville by many stakeholders as a major transport infrastructure issue. As will be discussed, the impact of smallholder market chain assistance has been diminished by low attention to feeder roads, at least in the agriculturally productive districts. Figure 21 is the most recent mapping of feeder roads in Bougainville although it dates back to 1980 (RASC 1980). Although the feeder road alignments have altered in many instances and a number of those active in 1980 are no longer considered essential for vehicular movement, the general distribution of the feeder roads is clearly illustrated. Clustered cocoa smallholder communities in Tinputz and Wakunai are reflected by high feeder road density. Feeder roads in the Arawa hinterland are associated with relict mine-related settlement, while in the south they are correlated with higher cocoa potential. Torokina has an undeveloped network.

#### *Feeder road funding by other agencies*

Feeder roads in Bougainville were initially to be addressed by EU.<sup>48</sup> EU estimated the cost of rehabilitation at K35,000 /km and noted that this was rising as the roads deteriorated. Despite EU work on 200km of roads, the majority of feeder roads were not rehabilitated. There are at least 900km of significant feeder roads across Bougainville. More recently, ABG in their 2007 budget has committed K10m to feeder road rehabilitation, which at the estimated K35,000/km may see a further 285km rehabilitated. Work on this has not commenced so far. ABG also budgeted for a ‘kina for kina’ scheme in which communities that raised funds for local road rehabilitation would have their funding matched by ABG. Work under this scheme has not commenced either.

#### *Feeder roads and agriculture*

Feeder roads in Bougainville serve two primary purposes: service access into isolated areas (health, education and law & order) and economic access from isolated areas to agricultural markets. ABG feeder road prioritisation may for a variety of reasons place ‘services’ roads above ‘economic’ roads. However, where agricultural production is potentially high but restricted by poor transport linkages, feeder road development might increase export revenue to justify it in cost and benefit terms.

Except for roads funded by the EU, feeder roads have for the most part deteriorated beyond the point where the usual small 4x4 ('Landcruiser' type) vehicles can travel them. Many of the ruts, washouts and mud-pits are too big for small 4x4 vehicles to negotiate. As a result, cocoa grown inland is often transported manually. Where a Landcruiser open-back can carry about 13 bags of dry cocoa, a fit man can carry only half a standard sack of wet or one full sack of dry cocoa. The distances to the trunk road can sometimes be in excess of 20km.

Tinputz and Wakunai districts in particular see high cocoa production potential in the mountainous areas well inland from the trunk road. DES officials and local farmers think that production is being held up by a lack of feeder roads transport. Some cocoa is being dried and stockpiled in the hills, or else not harvested at all, rather than being carried down to the buyers along the trunk road.

#### *Feeder road options*

Tractors are more able to negotiate degraded feeder roads than 4x4s. Although used in Torokina, tractors are rarely used in Tinputz and Wakunai, because inhabitants think the roads are often too long and at least inland, too steep for tractors.<sup>49</sup> NZAID have attempted the introduction of small 500kg-capacity rubber-track motorised barrows in Tinputz, Wakunai and elsewhere, but these appear not to have been met with enthusiasm.<sup>50</sup> The local political emphasis is on insisting that the roadways themselves be good enough for smaller 4x4 vehicles rather than encourage a shift to alternative vehicles.

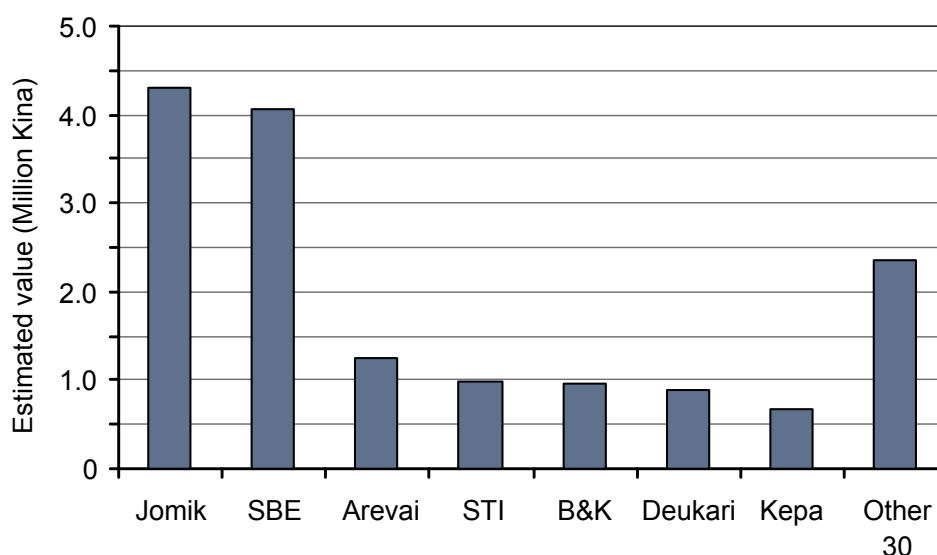
The economic case for feeder road development to be publicly funded (government or donor roadway investment) rather than privately funded (e.g. business investment in tractor vehicles) has diminished at this stage because at present the ABG does not receive all its revenue from cocoa production. Revenue is collected as a 10% goods and services tax (GST) on cocoa sales. While currently about K2.6M per month is collected in GST in Bougainville from cocoa, the Internal Revenue Commission Buka office estimated that about K0.25M remained uncollected for each month in 2006, or about K3M over the year. In total, IRC thinks about K10M is outstanding in cocoa revenue since approximately 2002-03.

### **3.2.6 Road contracting industry**

The road contracting industry consists of two distinct sectors; road plant owners and operators, and the community road teams. AusAID's approach to trunk road rehabilitation has been to foster a local road contracting and community road

**Table 11. Road plant types in Bougainville, February 2007**

Type of plant	Number of items	Estimated value in Kina
Truck	64	4,341,000
Dozer	21	4,296,000
Grader	9	3,618,000
Loader	10	1,480,000
Roller	5	783,000
Backhoe	5	510,000
Other	10	485,000
<b>Total</b>	<b>124</b>	<b>15,513,000</b>



**Figure 22. Estimated capitalisation of road plant by owner**

maintenance industry to add value to the local economy and help build equity in the road among people who could potentially disrupt the road program

#### *Road plant investment and ownership*

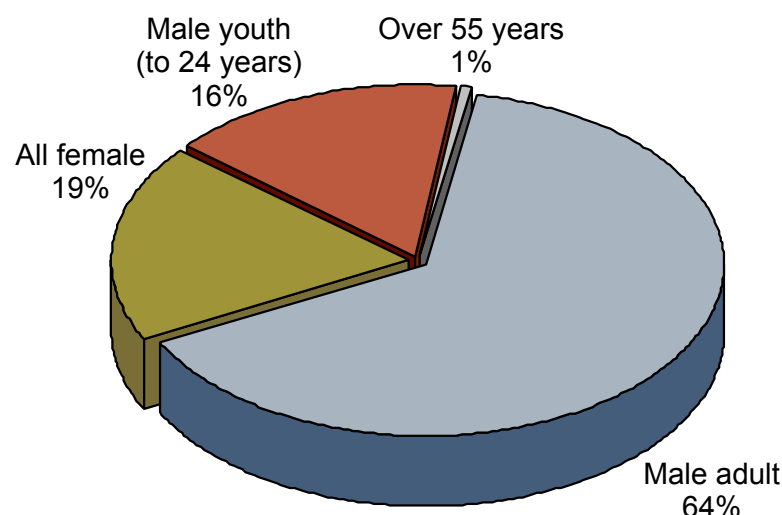
A survey was conducted among the road contracting industry stakeholders to determine the capitalisation and ownership of a road plant in Bougainville. Table 11 summarises the type, amount and approximate value of this road plant. The total value of this plant is estimated at K15.5M.<sup>51</sup>

The plant ranges widely in condition and value. At least 15 percent of the items (but perhaps as many as half) are pre-crisis, much of that ex-BCL. This plant is old and relatively low in value. A tentative estimated value of plant assets bought each year either new or from a second-hand source outside Bougainville is shown in Table 12. Values here are derived by attributing to an offshore source, all plant assets reported acquired each year, with a reported value of over K100,000, an assumption that is approximately correct. This shows that about 50 items of plant assets or about 75 percent of total plant value has been bought since the inception of BCTRRP/BCTRMP, mostly from new or high-end used equipment purchases outside Bougainville. Table 12 also indicates a gradual increase in the value of plant assets invested in each year, a sign of both increasing confidence in the road contracting industry and of increasing capital among leading contractors to fund such purchases.

**Table 12. Estimated value of plant bought outside Bougainville, by year**

Year	Estimated nr of items	Estimated value (Kina)
2007	8	3,716,000
2006	7	2,271,000
2005	7	1,428,000
2004	11	1,785,000
2003	0	0
2002	6	1,240,000
2001	3	479,000
2000	5	960,000
<b>Total</b>	<b>47</b>	<b>11,879,000</b>





**Figure 23. Community road teams by gender and age, 2006-07**

Concentration of this capital can also be estimated from the data. Much of the plant (106 items or K15.1M in estimated value) is associated with the Southern Consortium (comprised of Southern Bougainville Engineering and others), with the looser 'Central Consortium' in a more minor position (18 items or K0.39M in estimated value). These consortia are made up of many individual businesses, 37 in all that were identified. Of these, the top seven (all members of the Southern Consortium) own an estimated 82 percent by value of all road plant assets, with the remaining 18 percent owned by the other 30 owners (Figure 22). The two foremost owners, Jomik Plant Hire and Southern Bougainville Engineering, own an estimated 54 percent by value of all road plant assets.

### *Employment*

The road construction and maintenance contracting industry employs plant operators, mechanics and supervisors. These roles are distributed across the 125 items of plant and 35 owners, many of whom are sole operators, as noted above. Southern Bougainville Engineering itself has 75 full time employees, not including casual labourers and community road work teams. No industry-wide statistics exist, but it is reasonable to assume about 200 people overall are employed in the road contracting industry, all of whom are from Bougainville with the exception of two expatriate staff (a project manager and a plant mechanic). Many of the plant operators either worked with BCL or other heavy equipment contractor companies prior to the crisis. In addition to direct employment, the bigger companies employ night security to watch over plant on site.

### *Community road teams*

BCTRRP and BCTRMP also heavily use community road teams under a system of Community Agreements. The main work of these teams is the clearing of roadside vegetation, and reinstating drainage systems. The present study did not evaluate the impact of these agreements beyond the information already reported by the managing contractor.<sup>52</sup> The contractor reported in mid-2006:

The involvement of local community groups in the Project is considered a success in providing employment opportunity and pecuniary benefit. The Project has maintained its focus upon opportunity for women's groups and youth who may have been participants in the crisis. ... expenditure for community based work programs at project end reached 20% of the overall maintenance budget.<sup>53</sup>

Figure 23 presents age and gender characteristics of road team participants during BCTRMP exit phase (2006-07). It shows about 19% women employed, and some emphasis (16%) on employing male youth (approximately 16-24 years old). Another 64% employed were adult males.<sup>54</sup> Certainly community road teams are a feature of the trunk road, these teams often being seen working on the roadside margins. It is understood that many hundreds of Community Agreements have been implemented over the years the BCTRRP and BCTRMP projects have been operating. Note was made in Section 3.1.1 of the hold customary landowners now have over land that was public in pre-crisis times. Under these circumstances, the road has been remarkably free of local closures and vexatious claims for rent. This has occurred for example in post-conflict Solomon Islands, despite appeals to the public good of market and services access. The effect of trickle-down income through the Community Agreements appears to have spread equity in the road, acting against such hijacking.

### *Building the local contractor base*

The most influential company is South Bougainville Engineering (SBE). It is one of the main plant owners, and is the lead partner of the Southern Consortium, which wins most of the road contract work in Bougainville. SBE has managed many of the contracts awarded under the trunk road projects. The company was formed in 1993 by the Telei Interim Authority (in Buin), which foresaw opportunities for post-conflict road rehabilitation. To that end, equipment was bought, even during the crisis. Some of this equipment was worked in Lae, while the crisis dragged on. The equipment was on hand for the first contract awarded by BCTRRP.

To win the tender, SBE had to form a partnership with other plant owners, to assemble the plant required. SBE has a strategy of owning the key earthmoving equipment, but subcontract less critical plant operation such as earth cartage to independent truck owners and the like. This began the consortium concept. As the contractors obtained more work through BCTRMP, so they built up their plant. The small players restored pre-crisis machines while larger players like SBE and Jomik invested in new and near-new equipment. Unlike some of the other main players who are private businesses, SBE is owned by the seven Councils of Elders in Buin, all of which receive dividends from SBE and each of which has a director on the SBE board. The essentially community nature of SBE's shareholders means that SBE seeks profitable work while also doing gratis community work, such as levelling of village sports fields. It is also concerned with fostering work among the small independent operators.

A major constraint for growth of SBE and the contracting industry generally, is the supply of credit. The major banks, Bank of South Pacific and ANZ, are unwilling to finance investment in Bougainville. However, Credit Corporation PNG has been more helpful to SBE and two or three other plant owners in Bougainville. The extension of this credit has allowed SBE to build a good credit rating. Insurance is also expensive in Bougainville. SBE does acknowledge that Bougainville is still fragile, and investment must be cautious with regard to a possible decline in law and order.

Another constraint faced by the road contractors is uncertainty about the future of road contracting in Bougainville. This is currently funded by AusAID, but AusAID does not guarantee support on long time frames. An item of road plant takes about 3 years to pay off, so the risk in buying plant and then finding that AusAID has withdrawn its commitment to road maintenance is significant. Further, there is little confidence in the Bougainville contracting community that AusAID could successfully hand over responsibility for road maintenance funding to the ABG.

Business diversification is being explored by SBE, both in terms of the type of work undertaken and the possibility of working in other PNG provinces. The role of leadership in building up the industry is critical. A large player such as SBE is heavily reliant on the skills of its managing director and accountant. In Bougainville, such human resources are scarce. In this environment, management qualities of sobriety, transparency (as opposed to corruption) and ability to manage the many business relationships required within the consortium environment is essential.

### **3.2.7 Poverty, gender and peace restoration**

Covered here are impacts of the trunk road rehabilitation and maintenance projects on poverty, women's participation and peace restoration.

#### *Road project impacts on poverty and gender*

Trunk road rehabilitation has positively impacted on livelihoods, service access and community activities. Unlike the BCCDRP, which has had a more direct impact upon individuals and small groups via household-level projects, the benefits of improved travel have been significant but indirect.

The impact of the road is uneven across Bougainville in terms of gender and poverty and has been concentrated in Buka and on the northeast coast. The road has allowed these regions to access the services in Buka Town. The cost of travel to Buka Town from these nearby areas is much lower than from the south. Higher rural incomes in the northeast coast and lower fares in Buka imply that more people can afford to travel on PMVs. As agricultural activity is more vigorous in the northeast, road use for freight is also more intense. These traffic use patterns are in contrast with the south where the roads are almost empty due to low levels of agricultural and commercial activity. In the remote regions particularly in the mountainous areas of the south and on the western coast, the road has had little impact.

The road has opened up opportunities for the wealthiest to enter the road contracting industry by investing in key road plant. Others with less capital have entered the transport industry or the lower end of road contracting. For store-owners, the road has facilitated restocking and access to banking; by strengthening the economy and increasing spending power which has led to the improvement of commerce in the northern regions.

At the other end of the spectrum, are a large number of people who do not have cocoa money, who market their garden crops (root crops, greens and local fruits) in local markets for very low returns. There are stories of mountain people walking all night to sell a basket of garden produce at a town market, only to have enough money for a block of soap and a bag of salt at the end of the day. These people have gained almost nothing from the road; they have no money for PMV fares and have no access to the services or opportunities that entail travel by road.

These communities are concentrated in the South and West coast of Bougainville. The situation is considerably worse for remote and semi-remote rural women who vend their goods at the cheap local produce markets for marginal returns. They have no money for accessing health and other essential services by road. This lack of access among women to roads is most clearly seen in the gender mix in the PMVs. While short-run journeys (e.g. Buka to nearby Lonahan) are accessible to women with K2 or K3 to spare, longer

distances such as from Arawa to Kokopau are predominantly travelled by men. Rural women cannot afford the +K50 fare.

### *Road projects and peace restoration*

The road is often acknowledged by Bougainville people to have had a positive impact on the peace process. This impact is usually discussed in terms of the ease of mobility for people engaged in civil society activities, governance and post-crisis reconciliation meetings, which are still occurring. The income and employment provided from the agricultural sector has had a strong stabilising effect particularly in Buka and the northeast where agricultural production is strong. The road has not had this positive impact in the south where agricultural production is weak and the ensuing unemployment appears to feed into the ongoing political instability of this region.

The question as to whether the timing of road rehabilitation vis-à-vis the peace process was appropriate was investigated during the course of this study. Respondents in the northeast dismissed the proposition that the road had facilitated militants and highway outlaws in the absence of proper provision for law and order. Antisocial activities were restrained immediately post-conflict by local vigilante groups all along the road. The road later facilitated the movement of law and order officials. Roadside communities have developed a 'streetwise' culture of dealing with antisocial roadside behaviour.

People in the very remote areas of Torokina in the west and Orovo in the remote southeast expressed the contrary view that extending the road linkages to their area would cause trouble in their communities by allowing strangers to enter at will. Many respondents in both these places were adamant about their preference for a road-free status as this allowed them to live in peace. In future post-conflict environments programs of road rehabilitation should carefully consider the parallel establishment of law and order so as not to facilitate roadside crime and violence.

## **3.3 Impact of the wharves projects**

This section on the Bougainville Wharves Rehabilitation Project (BWRP) describes outcomes and impacts of the project. A summary of project intentions and costs is set out in Section 2.3.

### **3.3.1 Buka Port**

Buka wharf is the busiest in Bougainville, although it is used primarily for inwards coastal shipping of cargo and some inter-island passenger shipping. Buka port was insignificant in pre-crisis times. During the crisis, relocation of business and the government from Arawa to Buka gave Buka port greater significance. Rehabilitation through the BWRP increased the capacity of Buka port to handle container ships and to berth a number of ships simultaneously. Bougainville now has two deep-water ports, Buka and Arawa, both managed by Ports Corporation PNG.

#### *Passenger shipping*

Local passenger ships *Buka Queen* and *Sankamap* service the Nissan and Atolls districts. The larger passenger ships *Rabaul Queen*, *Morobe Queen* and *Solomon Queen* run between Buka and the provincial ports in Rabaul and Lae. No passenger ships ply to the other wharves in Bougainville, although it is possible for a limited number of passengers to ride to Kangu Jetty or back on *Boulari*.



**Buka port shipping, clockwise from top left: *Rabaul Queen* inter-province passenger ship; *Kaijin* loading break-bulk copra; Buka port area with container and barge shipping; *Morobe Coast* in Buka Passage**

### *Cargo shipping*

BWRP rehabilitation and extension of Buka wharf was completed in September 2003. The BWRP contractor built a new concrete container wharf as an extension to the existing old 'government' wharf. A new wharf apron approximately 120m long consisting of a berthage area 60m long and mooring wings 30m long on either end was constructed. A landing craft ramp was also built. A coronous gravel surfaced container handling area was developed with a capacity for about 240 containers.<sup>55</sup>

The first container ship arrived in October 2003, from which time container ships operated by Consort Express Lines have berthed on a fortnightly schedule. Prior to that, all cargo was shipped break-bulk. Depending on the goods carried, break-bulk cargo is usually shipped in agricultural produce bags or fuel drums or on forklift pallets and loaded using a cargo net and derrick. Upon construction of the new wharf, a stevedoring company, Makerio Stevedores, was engaged to manage the container traffic. The wharf area as a whole is ceded to PNG Ports Corporation.

Although the wharf was built to handle ships of up to 7300 deadweight tonnes (DWT), the container ships that regularly use the facility are Consort Express Line's *Morobe Coast* (2298 gross tons, 2905 DWT), *Madang Coast* (1951 gross tons), and *Sepik Coast* (2000 gross tons).<sup>56</sup> These are the largest ships that berth at Buka, indicating the wharf capacity was over-specified by a considerable margin possibly because international container ship handling was envisaged. This has not eventuated.

Accurate data on port usage is important for impact evaluation of the BWRP activity in Buka. The amount of inward and outward shipping for Buka port was derived from port charge invoice (PCI) data. PCIs are consecutively numbered invoices issued to ship captains on departure from the port which itemise charges for berthage and for various



categories of cargo loaded or unloaded, in ‘revenue tonnes’. One revenue tonne is either one cubic metre or one tonne by weight, whichever is higher in numeric value. PCIs provide tonnage in and out by vessel, date and category of goods. The duplicate copies of the invoices remain at the Buka port office.

This data was transcribed and compiled from January 2000 to September 2006 for use in the present study.<sup>57</sup> Its advantage over the official Harbours Board figures was twofold. First, Harbours Board figures did not appear to disaggregate accurately cargo shipped in containers from break-bulk cargo. This disaggregation is important for the present study because the main feature of the BWRP in Buka was the conversion of the old Buka facilities into a container shipping port the effect of which must be assessed. Second, detailed data allows for vessel-level analysis including the matching of PCI data to other vessel lading data i.e. from Coconut Products Limited (outward copra tonnage) and Makerio Stevedores (inwards and outwards containerised cargo).

Some discrepancies in overall cargo volumes between the PCI data and Harbours Board figures are apparent from a comparison within Table 13. Harbours Board data (*B*) is also indirectly based on PCI data, received via the monthly harbour master’s reports that are compiled in the Harbours Board head office. The PCI data (*A*) directly obtained by the study is preferred for the current analysis. One difference is that the PCI records tend to count containerised cargo predominantly as ‘non-enumerated goods’ (i.e. general cargo) and only a portion as containerised cargo, whereas in reality almost all cargo on the container ships is shipped in containers. To account for this, all cargo exclusively from the container ships was summed for each quarter and categorised as containerised tonnage. Note that apart from fuel, agricultural produce and the inconsistently applied category of container cargo, practically all cargo is classified in the PCIs as ‘non-enumerated’.

There are some difficulties with the PCI data. First, from the beginning of 2005, port charges do not appear to have been officially applied to outward containerised cargo (resulting in almost zero recorded revenue tonnage), although itemised stevedoring records were obtained showing that this cargo continued to flow via the fortnightly rotation of container ships. Second, a complete set of CPL bills of lading were obtained

**Table 13. Comparison of yearly summary data for Buka port**

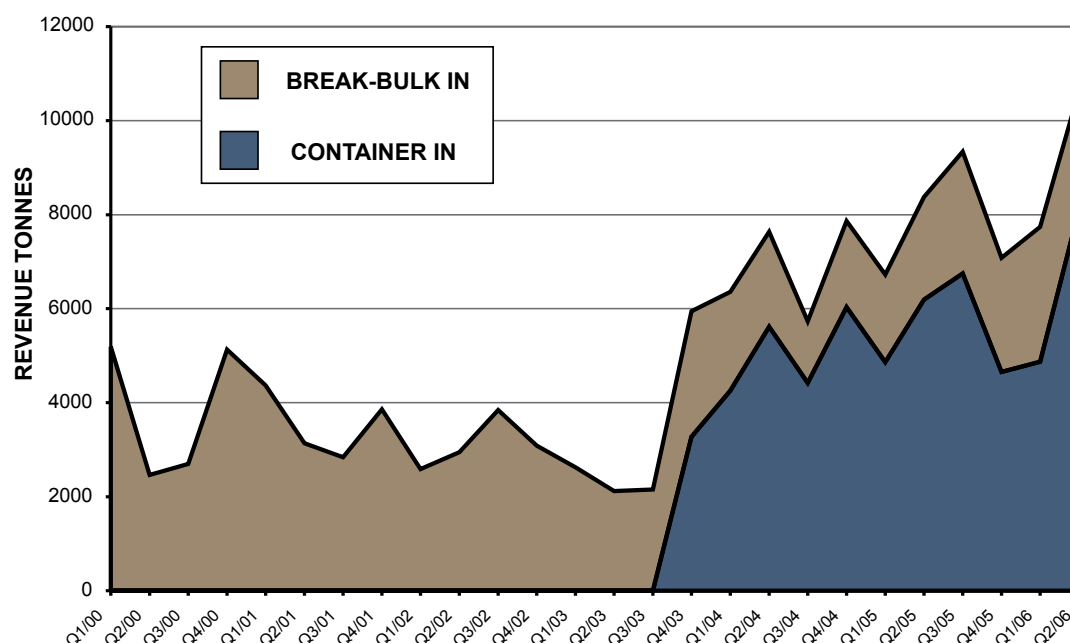
**A. Buka port yearly summary from PCI data (revenue tonnes):**

Year	Total Inward	Container Inward	Total Outward	Container Outward
2000	15,476	-	17,219	-
2001	14,201	-	2,455	-
2002	12,458	-	3,719	-
2003	12,839	3,273	9,350	1,143
2004	27,591	20,321	17,534	4,215
2005	31,526	22,459	10,583	64

**B. Buka port yearly summary from Harbours Board figures (revenue tonnes):**

Year	Total Inward	Container Inward	Total Outward	Container Outward
2000	-	-	-	-
2001	13,623	-	2,142	-
2002	12,975	-	2,996	-
2003	12,385	2,100	9,681	400
2004	40,994	15,421	17,004	3,160
2005	30,316	6,510	19,738	960





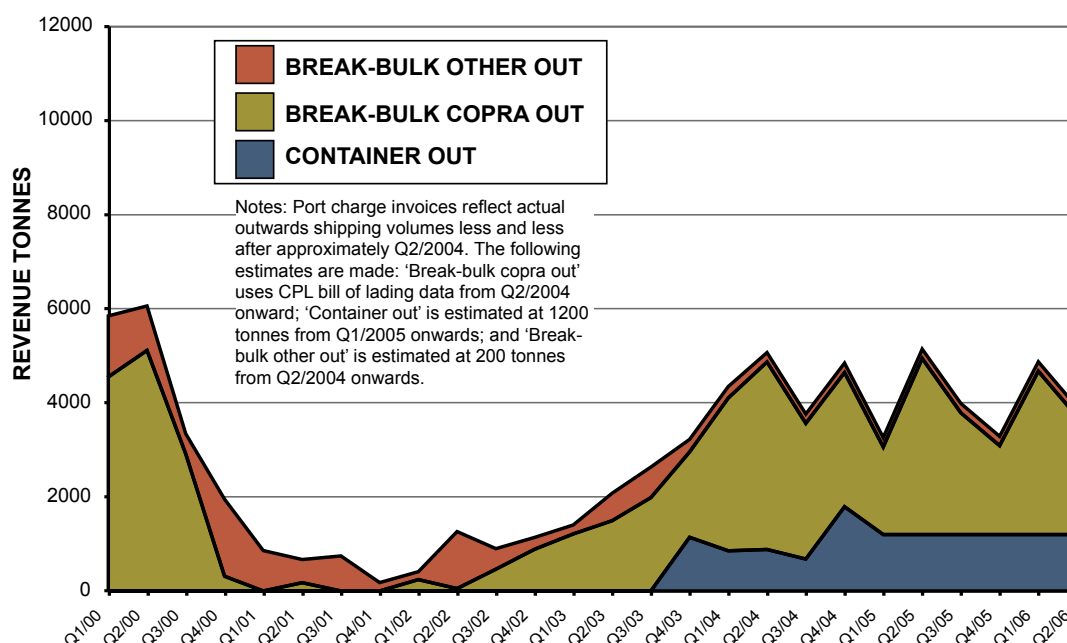
**Figure 24. Quarterly inwards cargo, Buka port, Q1 2000 to Q2 2006**

for break-bulk copra shipments from March 2004 onward, which show marginally higher amounts of copra shipped than can be tracked through the PCIs.<sup>58</sup> Recording of other outward break-bulk cargo also appears to decline sometime during or after 2004. No assessment can be made of the recording of inward cargo, as there is no obvious pattern of visible under-recording. Since a primary objective of the present study is to determine actual port usage, estimates are applied to the post-2004 data as explained below.

Inward cargo to Buka port from beginning January 2000 to end June 2006 is shown in Figure 24. It indicates the appearance of containerised shipping in the last quarter of 2004 against the backdrop of total inwards cargo. Total inwards cargo, both containerised and break-bulk, exceeded 10,000 revenue tonnes in the second quarter of 2006, about 8,000 tonnes of which arrived in containers. The effect of the BWRP activity is clear. Once containerised shipping facilities were provided, total inwards cargo leapt to about double the previous inwards cargo amounts. Simultaneously, containerised shipping took away tonnage from break-bulk shipping. Smaller shipping operators do not carry the same amount of cargo into Buka port as they did prior to the appearance of the container ships. However most fuel still arrives in 200 litre drums on the smaller ships, and palletised cargo, mostly retail store goods, also make up a large part of smaller ship cargoes. Inwards containers appear to mostly consist of retail store goods.

Outward shipping for Buka Port, also for the period January 2000 to mid-2006 is shown in Figure 25. It also indicates the marked effect of copra export tonnage on total outward shipping tonnage. The period 2001-2002 when the copra industry was in disarray is indicated as a slump in total outward shipping.

While total outwards cargo in recent years has been less than the inwards cargo, the arrival of containerised shipping facilities appears to have increased total outward shipping. However data for the period late 2004 onwards must be treated cautiously. As explained earlier, the PCI dataset under-reports outward tonnage, especially containerised tonnage. PCI figures for the period after Q1/2005 also suggest zero outward container tonnage and very little break-bulk tonnage. To arrive at a more accurate assessment, an estimated 1,200 tonnes containerised cargo is substituted for the low PCI figures from Q1/2005 onwards and, an estimated 200 tonnes break-bulk non-copra cargo



**Figure 25. Quarterly outwards cargo, Buka port, Q1 2000 to Q2 2006**

is substituted for low PCI figures from Q2/2004 onwards.<sup>59</sup> Copra tonnages from Q2/2004 onwards are derived from CPL records which were slightly higher than the PCI values. Although this substitution is not ideal, it represents the actual situation more satisfactorily than that based wholly on PCI data.

Stevedoring records for 2005 and 2006 show the makeup of the fortnightly containerised outward shipping. Some retail goods such as rice and soft drinks are regularly transferred at the wharf from the Buka inward containers to containers bound for Kieta. The fuel drums that come in break-bulk on small vessels, when returned empty to the wharf, are often backloaded to Lae in containers. Empty beer bottles and aluminium-can scrap-metal is frequently loaded, as are small quantities of marine products, copra, cocoa and coconut products. Cocoa is only shipped from Buka to Rabaul in containers by Outspan. Similarly, containerised copra was shipped by Pemana in 2005 and COPM in 2006. Coconut products were shipped out by BMF and City Pharmacy, while scrap metal, beer bottles and marine products are shipped by a small number of businesses. Additional marine products are likely to be shipped break-bulk by *Sankamap* and *Buka Queen* in particular, which regularly visit the harvesting areas in Nissan and the Atolls districts. There is a constant flow of miscellaneous goods, often machinery, usually to Lae and Port Moresby. Table 14 indicates the amounts of revenue-earning outwards shipments by container, based on data from stevedoring records and cocoa buyer records (for cocoa) for 2005 and 2006.<sup>60</sup>

**Table 14. Estimated revenue tonnages of containerised goods, Buka port**

Goods out	2005 (tonnes)	2006 (tonnes)
Empty beer bottles	260	233
Scrap aluminium cans	65	56
Copra	1,522	794
Cocoa	-	350*
Marine products	12.2	25
Coconut products	4.4	3.2



**Loading copra onto a water taxi at Kokopau ; Kangu jetty and shed**

Buka Passage remains a barrier to the efficient movement of cargo between Buka and Kokopau (and the whole mainland) and is the main reason why cocoa is shipped from Kokopau rather than Buka. Prior to the crisis a vehicle ferry operated across the passage, allowing cargo to remain loaded as it moved across the passage. This was destroyed in the crisis. The accompanying photograph shows the arduous process of mainland copra producers loading their produce onto a water taxi on the Kokopau side to sell in Buka, having unloaded it earlier from a truck.

Buka wharf reconstruction and provision of container facilities has primarily benefited traders shipping consumption goods into Bougainville. It is convenient for berthing the inter-island passenger ships and break-bulk coastal traders, but they make no special use of the container facility. Because of the tonnage taken away from the smaller coastal vessels relying on break-bulk shipping, it has been less of a benefit to them. While the establishment of the container facility correlates with some increase in export shipping, the volumes are small. The main export crop from Buka wharf is copra which is predominantly shipped break-bulk and does not use the container facility. Indeed the copra ships still berth at the old unrenovated section of the wharf, from which the break-bulk copra shipment in 2006 was about 11,400 tonnes with a store value of about K5.9M (see Section 3.1.2 and 3.1.4). This benefit cannot be attributed to BWRP. However, the increase of wharf length has allowed more ships to berth simultaneously, which has improved its capacity even though it may not have generated any financial value.

The decision to scale up Buka wharf to suit international shipping was wasted money. As with other RWA projects, notably the BCCDRP, infrastructure was provided but little consideration was given to the institutional framework and capacity for regulation into which it was placed. In this case, PNG Ports Corporation realised that to open international shipping into Buka (additional to the facility in Kieta) was beyond its capacity to manage and so they refused to do so. In summary, the investment by BWRP in Buka wharf has not had a marked impact on economic production as part of the smallholder market chain in Bougainville.

### **3.3.2 Kangu Jetty**

The Kangu Beach project constructed a concrete jetty, about 230 m long into the shallow sea at Kangu Beach, facing the Shortland Islands. A concrete and gabion landing craft ramp was also built into the sand beach at Kangu and a large fenced storage compound with a vast warehouse installed nearby. Inside the storage compound is a new incomplete weighbridge. By all accounts, the storage facility has never been used.

The rather desolate Kangu area is devoid of any other commercial activity, although there are two small hamlets near the jetty. The length of the jetty does not allow large vessels, such as container ships, to berth. The actual berthing area has a capacity for two typically sized coastal traders to moor, one on either side, in relatively deep water. The shed built at Panakei was not seen, but apparently has never been used for goods storage. It is being used by the police at present.

Sea traffic to Kangu consists mainly of fortnightly visits by Agmark Shipping's *Huris* and Garamut's *Boulari*. Occasionally other ships such as *Sankamap* are seen. These ships land pallets of goods coming in, mainly from Rabaul, for local business. Except in the southern cocoa season (March to June) the ships do not load cargo at Kangu. Cocoa in the south has relatively poor yields and the ships do not load fully at Kangu. In Figure 11 of Section 3.1.3 it is estimated that just over 1,000 tonnes of cocoa (with a store value of about K4M) was shipped from Kangu in 2006. Kangu continues to be plagued by disputes between local landowner groups and consequently suffers from less than optimal stevedoring arrangements. The storage facilities are considered insecure by local businesses. Apart from small palletised shipments that can be unpacked and trucked to Buin before nightfall, the traders favour containerised shipping to Kieta, which, although Kieta is also thought unsafe, at least allows cargo to be locked inside the container.

Kangu Jetty is often branded in Bougainville as a 'white elephant', due to perceptions of its large size and expense relative to its low shipping traffic. However, it is clear from the Project Design Document that its size was a decision based on expectations that post-crisis agricultural output would match or exceed that recorded in pre-crisis times. Two unforeseen factors militated against this: 1) cocoa no longer seems to grow as well as it once did in the south and 2) the peace process in the south stalled in 2004, which stymied further agricultural assistance to the south.<sup>61</sup>

### 3.3.3 Other wharves: missing links

Two other major wharves exist in Bougainville. These are the Ports Corporation facility at Kieta and the cocoa wharf at Kokopau, directly across the Buka Passage from Buka Port. In addition, there are a number of other small wharves.

#### *Kieta Port*

The PNG Ports Corporation port of Kieta was the main dock in Bougainville pre-crisis, and was fitted with international container ship handling facilities. It shut down during the crisis and its facilities were severely degraded. Post-crisis, it reopened and under PNG Ports Corporation is still the only international port in Bougainville. Apart from some EU assistance, it has not received rehabilitation and remains degraded. Since the locus of economic activity has shifted to Buka, Kieta is no longer the busy port it was pre-crisis. However, it is favoured by businesses in the south (Buin, Kieta and Bana) because of its container facility which allows relatively secure inwards cargo storage, an asset that has not eventuated at Kangu Beach. For the southern traders, it is not nearly so far away as Buka. Some cocoa and copra is sent out from Kieta, although this is insignificant in comparison to the Kokopau cocoa and Buka copra traffic. Kieta cocoa and copra appears to come mainly from the south end of Wakunai district, Arawa and the three southern districts. Despite its low volumes, small dealers favour Kieta because its international shipping offers the opportunity to sell container-loads of produce directly to overseas buyers.



**Huris loading copra at Kokopau; the undeveloped landing site at Torokina**

### *Kokopau wharf*

Kokopau is the busiest wharf for agricultural export. In Figure 11 we estimated that it was used for shipment of about 10,000 tonnes of cocoa, with a store value of about K40M, ten times that from Kangu. While it was not part of AusAID's rehabilitation plan, it was stabilized perfunctorily with gabions under EU funding. It sits at the head of the coastal trunk road and is the outward port for two-thirds of Bougainville's cocoa. Both Agmark Pacific and the smaller Garamut have cocoa warehouses near the wharf and their respective vessels use it heavily. Located next to the gravel beach landing for 'banana boat' passenger ferries to Buka town across the Buka Passage and also next to the inter-town PMV terminus, Kokopau is the busiest of all the wharves in Bougainville. Although an old government wharf, the crisis saw landowners claim ownership of it and it is presently managed by a landowner stevedoring group. The old structural steelwork under the new decking has rusted to the point of dilapidation.

### *Small wharves*

Although not included within AusAID's scope for transport infrastructure assistance, small wharves around Bougainville are used for outward shipping of crops, notably cocoa. Some of these wharves are economically valuable. In pre-crisis Bougainville, many small wharves were maintained as part of mission or plantation enterprises. The number of operable small wharves has reduced in the post crisis period with those consistently used post-crisis being Tinputz, Wakunai and Torokina.

Some funding for small wharves was made available by EU under Stabex, a K1.44m component intended originally for the purchase of a landing craft. The EU's plan subsequently changed to wharf rehabilitation as Agmark landing craft began shipment from small wharves around late 1999 – early 2000. Although the Wakunai landing craft ramp and Torokina beach were investigated for improvement, funds were eventually diverted for rehabilitation of the produce storage shed at Kieta Port and for the later rehabilitation of Tinputz jetty. This has meant that Wakunai only has an old concrete pad set in the shoreline sand, and Torokina has nothing. Both locations could usefully have a concrete ramp leading from the landing to a stevedoring shed and vehicle turning area, and gabion breakwaters incorporating mooring bollards on either side of the ramp. This would allow road vehicles to enter the hull directly, speeding up the lading process which would improve the commercial viability of these landings.



### 3.3.4 Missed opportunities of BWRP

In terms of smallholder market chain rehabilitation, the impact of BWRP has been indirect at best. The rehabilitation and extension of Buka port represents the most significant economic impact of the BWRP although this has mainly been through improvements to the efficiency of inward cargo traffic, which for the most part consists of consumption goods. It has had a marginal impact towards assisting outward movement of export crops, and it cannot be said to have contributed significantly to overall market chain efficiency.

Kangu Jetty is used to some extent for low tonnage outward cocoa movement, an improvement that could have been attained by building the landing craft ramp alone (with a hardstand leading to it). In a nutshell, Kangu was massively overcapitalised. The storage sheds at Kangu and Panakei in Siwai have not been used and while the under-use of facilities in the south could not have been fully anticipated, the works have been overcapitalised, leading to the ‘white elephant’ moniker.

The EU promised rehabilitation of the most strategic agricultural shipment points: the wharf at Kokopau and the landings in the agriculturally rich Wakunai and Torokina districts, but did not allocate sufficient funds for the job. Their choice was probably influenced by AusAID’s prior staking out of work on Kangu and Buka wharves based on proposals that were driven by engineers, weak on economic analysis and never critically examined. AAB was from the beginning set on rehabilitation of wharves in low-yielding agricultural districts which notwithstanding were developed to a high standard anyway. The lack of follow through by EU has left Kokopau wharf and the facilities at Wakunai and Torokina underdeveloped. Concomitantly, AusAID’s expensive wharf rehabilitation activity has left many with the impression that wharf rehabilitation was entirely an AAB domain and that the shortfall is the result of BWRP’s misallocation of resources.

A lack of clear allocation of responsibilities between the two donors and no shared overarching strategy based on clear precepts of market supply chain rehabilitation and

**Table 15. BCCDRP total projects distributed, by type**

Project type	Phase 1	Phase 2	Total
<b>A. Cocoa &amp; copra dryers</b>			
Cocoa dryer repair	1,368	93	1,461
Cocoa mini dryers	785	531	1,316
Copra dryer repair	31	22	53
<b>Total cocoa/copra dryers</b>	<b>2,184</b>	<b>646</b>	<b>2,830</b>
<b>B. Trust Fund projects</b>			
Poultry	459	295	754
Cocoa tools	327	272	599
Pigs	138	342	480
Bakery	168	150	318
Vanilla	124	67	191
Fishing	80	101	181
Other agricultural	35	50	85
Non-agricultural	14	107	121
Other	31	29	60
<b>Total Trust Fund projects</b>	<b>1,376</b>	<b>1,414</b>	<b>2,789</b>
<b>Total Projects</b>	<b>3,560</b>	<b>2,059</b>	<b>5,619</b>



clear analysis of the economic geography meant that the economic potential of the BWRP was limited from the very outset.

### 3.4 Impact of the cocoa dryer and trust fund projects

This section on the BCCDRP describes project outcomes and impacts. The original intentions are discussed in Section 2.4. The BCCDRP was comprised of a number of components. Two in particular are of interest here: 1) the BCCDRP cocoa dryer distribution which formed the critical crop-processing link between rehabilitation of the cocoa crop and transport to market and 2) the BCCDRP rural development trust fund which assisted in the establishment of downstream businesses. In the following presentation, the range of BCCDRP outputs is discussed first, followed by an evaluation of the dryer and trust fund components and finally, an evaluation of the BCCDRP firewood tree seedlings project.

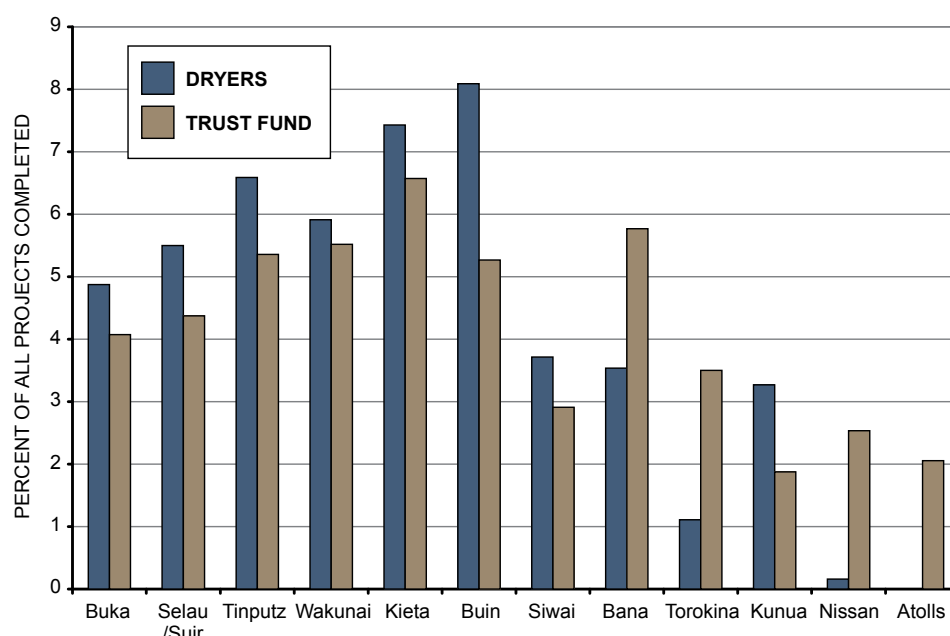
#### 3.4.1 BCCDRP outputs

Outputs from BCCDRP activities were of three types: cocoa dryer rehabilitation and supply, trust fund projects and the firewood seedlings project. A definitive set of data on the numbers and types of dryer and trust fund projects completed under BCCDRP was not available and anomalies exist between the various data that was located. The tables below were compiled from the latest and/or most complete data available and vary slightly with BCCDRP's figures used in reporting its achievements.<sup>62</sup> Table 15 summarises the total number of projects distributed by type under phases one and two, for cocoa/copra dryer and trust fund components.

About 5,600 projects were delivered overall, with about as many trust fund projects dispensed as the cocoa and copra dryer projects. Phase 2 supplied about 30 percent of the dryers that were provided in Phase1, but delivered slightly more trust fund projects than did Phase1. Overall, Phase 2 dispensed about 60 percent less projects overall than did Phase 1, although it did so in a shorter two year timeframe (2004-2006) as compared to the four-year time frame of Phase 1 (2000-2004).

**Table 16. BCCDRP total projects distributed, by district**

DISTRICT	Cocoa Repair	Cocoa Mini-dr	Copra Repair	Poultry	Cocoa Tools	Pigs	Bakery	Vanilla	Fishing	Other	All Projects
Buka	137	106	30	48	14	52	42	20	23	29	501
Selau Suir	187	116	5	53	48	36	56	18	22	12	553
Tinputz	151	217	1	103	77	28	62	11	15	4	669
Wakunai	169	161	1	177	54	45	11	12	5	5	640
Kieta	191	220	5	68	82	54	76	29	18	41	784
Buin	102	349	2	82	131	34	13	15	6	14	748
Siwai	121	87	0	59	16	33	4	29	2	20	371
Bana	114	84	0	100	55	97	12	15	2	42	521
Torokina	49	11	2	26	75	52	10	6	12	15	258
Kunua	89	90	4	16	36	14	17	4	8	10	288
Nissan	6	0	3	8	11	32	14	32	7	38	151
Atolls	0	0	0	14	0	3	1	0	61	36	115
<b>TOTAL</b>	<b>1,316</b>	<b>1,441</b>	<b>53</b>	<b>754</b>	<b>599</b>	<b>480</b>	<b>318</b>	<b>191</b>	<b>181</b>	<b>266</b>	<b>5,599</b>



**Figure 26. Distribution of BCCDRP dryer and trust fund projects by district**

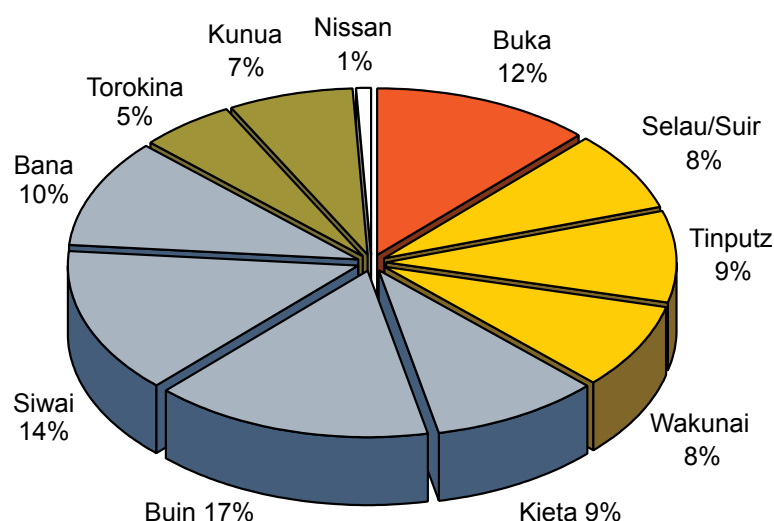
Table 16 details the distribution of project types by district.<sup>63</sup> A better idea of the relative distribution of dryer and trust fund projects is provided in Figures 29 and 33 respectively. The proportion of dryer projects (cocoa and copra dryer rehabilitation or mini-dryers) to trust fund projects is shown in Figure 26, which indicates that dryers were favoured over trust fund projects in almost all districts.

Complementing the rehabilitation of dryers and distribution of mini-dryers, BCCDRP reported that in Phase 1, training was provided in post-harvest processing, while in Phase 2 training in dryer operation and quality cocoa processing was delivered by BCCDRP and DPI staff to 2,083 women and 2,461 men. The fabrication of mini-dryers in a number of workshops also generated employment.<sup>64</sup>

BCCDRP further reported that for Phase 2, the equity paid by dryer beneficiaries was K861,000, while that paid by trust fund beneficiaries was K565,000. BCCDRP calculated that household income among beneficiaries increased from K1,700 to approx K4,300.

**Table 17. Cocoa tree stock assessment 1999 (Kondorr and Rahmann 1999)**

District	Damaged or Senile (unviable)	Share of Unviable	Bearing Viable	Immature Viable	Total Viable	Share of Viable (%)
Buka	1,193,664	5.7	762,588	72,273	834,861	7.8
Selau/Suir	3,186,452	15.2	525,141	99,031	624,172	5.8
Tinputz	1,126,766	5.4	1,783,453	87,498	1,870,951	17.5
Wakunai	3,860,351	18.4	1,678,067	641,632	2,319,699	21.7
Kieta	1,516,220	7.2	553,924	132,328	686,252	6.4
Buin	4,421,227	21.1	567,459	261,117	828,576	7.7
Siwai	2,111,421	10.1	1,207,055	401,960	1,609,015	15.0
Bana	2,008,381	9.6	266,126	199,319	465,445	4.4
Torokina	644,935	3.1	1,111,880	127,600	1,239,480	11.6
Kunua	877,339	4.2	129,554	85,103	214,657	2.0
<b>Total</b>	<b>20,946,756</b>	<b>100</b>	<b>8,585,247</b>	<b>2,107,861</b>	<b>10,693,108</b>	<b>100</b>



**Figure 27. Distribution of BCCRP cocoa seeds and seedlings by district**

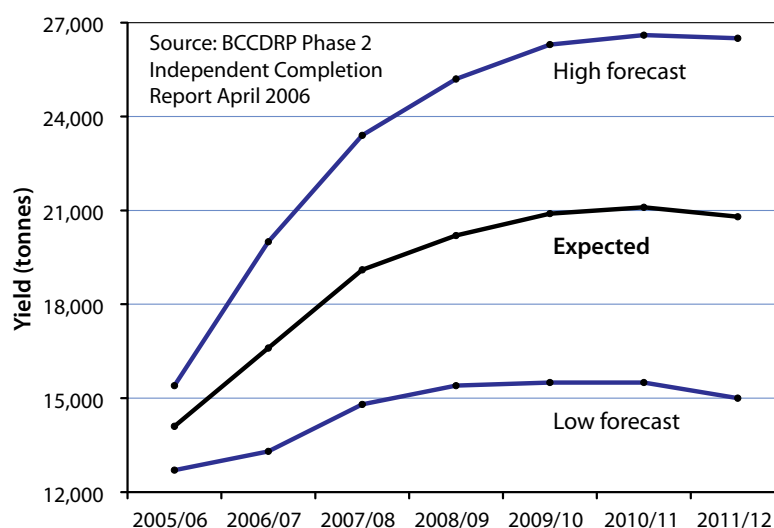
### 3.4.2 Context to BCCDRP: related programs

As discussed in Section 1.2.2, BCCDRP was implemented in the context of a number of donor initiatives that were aimed at rehabilitating Bougainville's economy and providing a direct stimulus to economic activity principally by assisting cocoa and copra production and micro-enterprise. In this context, the UNDP Bougainville Cocoa and Copra Rehabilitation Project (BCCRP) must be mentioned as playing a critical role through distributing cocoa seeds and seedlings to rehabilitate Bougainville's damaged tree stock. Projects by NZAID and NGOs such as Oxfam and ADRA also delivered small projects similar to those of BCCDRP.

AusAID established the Bougainville Ex-combatants Trust Account (BETA) project, a \$5M incentive scheme to assist combatants to reintegrate by funding grassroots development initiatives in communities that had disarmed. BETA was set up in May 2002.<sup>65</sup> While BETA is not a subject of the present evaluation, by all accounts it was unsuccessful in peace-building.<sup>66</sup> Most of these projects are likely to have had a cumulative impact on cocoa production and household income in Bougainville, the individual effects of which cannot be disaggregated. However, BCCDRP was the largest among all crop processing projects and micro-enterprise initiatives.

**Table 18. BCCRP cocoa seed distribution by district**

Districts	Seed Distribution Apr?1998 - Sep 2001 (1)	Cocoa seeds distributed Jul-Dec 2002 (2)	Hybrid cocoa seeds distributed Apr 2004 - Mar 2005 (3)	Total accounted seed distribution
Buka	709,366	305,000	204,000	1,218,366
Selau/Suir	524,950	230,000	136,000	890,950
Tinputz	702,088	150,000	151,000	1,003,088
Wakunai	656,300	75,000	141,500	872,800
Kieta	852,823	120,000	136,500	1,109,323
Buin	1,346,075	175,000	136,500	1,657,575
Siwai	1,191,390	105,000	136,500	1,432,890
Bana	716,500	120,000	136,500	973,000
Torokina	359,600	60,000	136,500	556,100
Kunua	503,205	75,000	136,500	714,705
Nissan	5,000	15,000	58,000	78,000
Total	7,567,297	1,430,000	1,509,500	10,506,797



**Figure 28. Bougainville cocoa production forecast**

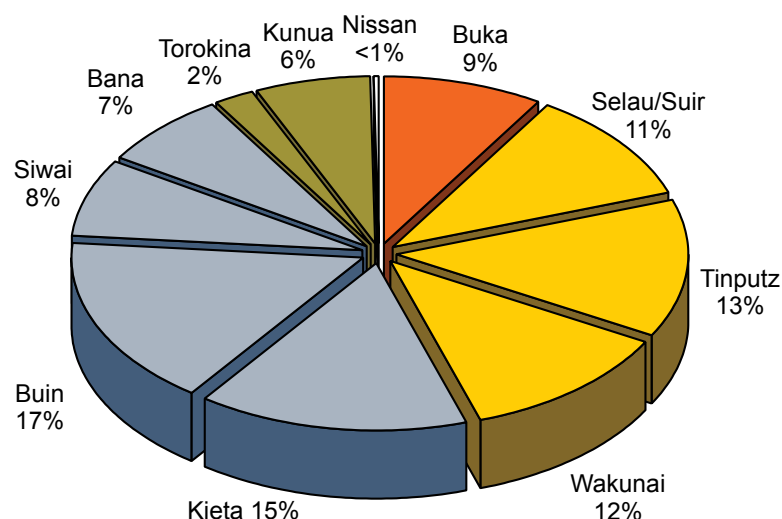
*BCCRP: UNDP's Bougainville Cocoa and Copra Rehabilitation Project*

Although external to the present impact assessment, the UNDP BCCRP was a core part of the market chain assistance to Bougainville and its inclusion in this discussion is unavoidable for obtaining an understanding of AusAID's assistance to the market chain. BCCRP was a response to a general awareness of the disarray of the cocoa and coconut industries in Bougainville, in particular the 1999 baseline survey which concluded that 20 million cocoa trees and one million coconut trees needed rehabilitation or replacement (Table 17). The general target was set at replanting these trees over a five-year period from 1998 to 2003.<sup>67</sup> The impact of the cocoa tree rehabilitation in particular has been considerable.

After its inception in April 1998, BCCRP operated nurseries that distributed seeds and seedlings. Two-month old cocoa seedlings, or if unavailable then seeds, sufficient for a one hectare lot (720 plants) were distributed gratis to cocoa growing households to re-establish their cocoa gardens. Funding was provided by the UNDP, EU and AusAID.<sup>68</sup> AusAID contributed K2.01M to Phase 3 (July 2000 to June 2002), 32 percent of the total funding for this phase. AusAID co-funded a further component of BCCRP (\$ 4.6 M)

**Table 19. BCCRP cocoa seedling distribution by district**

Districts	Seedling Distribution Apr?1998-Sep 2001 (4)	Cocoa seedlings distributed Jul-Dec 2002 (5)	Clonal seedlings for distribution Apr 2004 - Mar 2005 (6)	Total accounted seedling distribution
Buka	443,480	419,837	65,000	928,317
Selau/Suir	291,428	140,509	60,000	491,937
Tinputz	379,571	150,979	45,000	575,550
Wakunai	410,243	129,296	60,000	599,539
Kieta	276,061	258,628	40,000	574,689
Buin	745,286	325,773	49,000	1,120,059
Siwai	818,425	226,959	20,000	1,065,384
Bana	665,020	156,244	63,000	884,264
Torokina	251,720	146,125	0	397,845
Kunua	293,017	155,222	58,000	506,239
Nissan	0	45,134	39,000	84,134
Total	4,574,251	2,154,706	499,000	7,227,957



**Figure 29. Distribution of BCCDRP cocoa dryer projects by district**

which distributed approx 2 million cocoa seedlings and developed the capacity of the Cocoa and Coconut Institute to support farmers on an ongoing basis.<sup>69</sup>

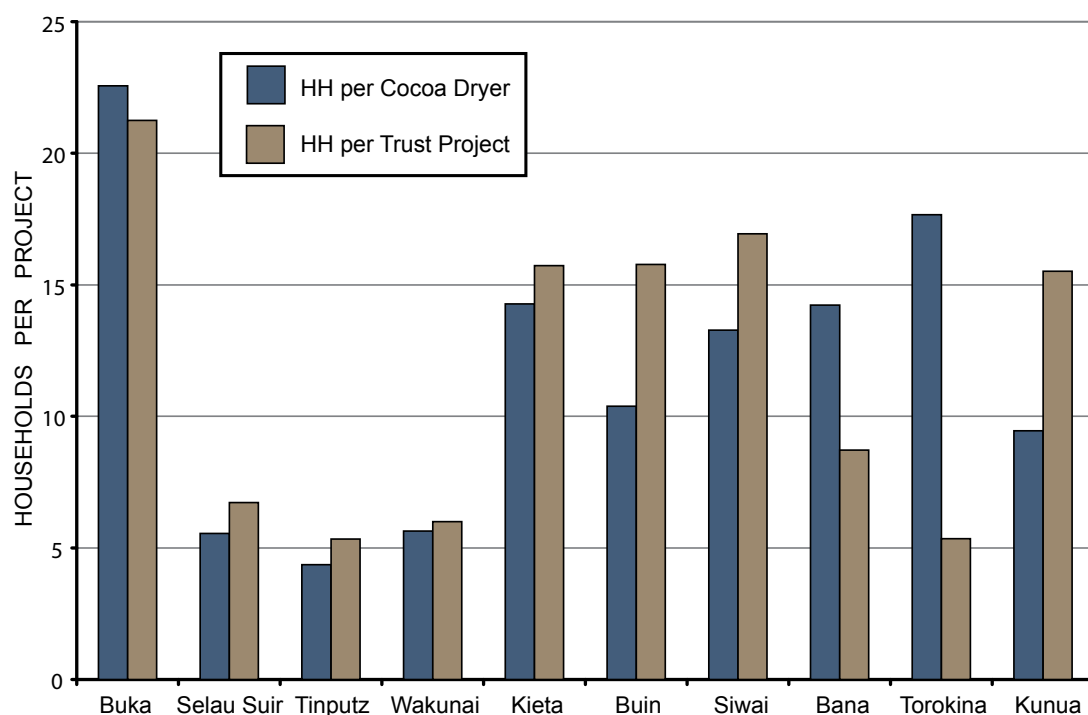
The present study could not locate complete figures for BCCRP seed and seedling distribution by district.<sup>70</sup> Data from various reports is assembled in Tables 18 and 19.<sup>71</sup> This lacks data for the periods October 2001 to June 2002 and January 2003 to March 2004. Distribution under BCCRP appears to have ended later in 2005.

The combined total known seed and seedling distribution shown in the tables exceeded 17.7 million seeds and seedlings. The proportion of known distribution by district for seeds and seedlings combined is shown in Figure 27, colour-coded by economic region. This shows that the south received 50 percent of known seed and seedlings. Attrition rates of cocoa seeds and seedlings vary across Bougainville and are probably highest in the south. Hence, the distribution of material supplied will not correlate uniformly with eventual cocoa production as seeds and seedlings mature and begin fruiting. Even so, BCCRP laid the basis for a rejuvenated cocoa industry, with fruit from these trees beginning to appear around 2005 which can be expected to boost production until about 2015, when senescence of the short-lived hybrid used will begin to set in. Figure 28 forecasts the future production curve resulting from BCCRP.<sup>72</sup> Notably, the ramping of production will strain current cocoa-associated infrastructure (fermentaries, roads and wharves) as well as the regulatory arrangements for cocoa production.

Cocoa planted through BCCRP is different from the older 'colonial' hybrids such as Trinitario, a type especially favoured for fine chocolate. The BCCRP rationale is that the

**Table 20. Distribution of cocoa stock rehabilitation and dryer renewal compared**

Economic region	Buka	Northeast	South	West coast
Cocoa seed and seedling distribution	12%	25%	50%	12%
Cocoa dryer rehabilitation and mini -dryer distribution	9%	36%	47%	8%



**Figure 30. Distribution of BCCDRP projects by household by district**

new hybrids with intensive management can yield up to 3 times more per hectare than the older ‘colonial’ hybrids, and the later hybrids are far less susceptible to devastating phytophthora pod rot (‘black pod’) which threatens Bougainville.<sup>73</sup> Conversely, many growers are dissatisfied with the new hybrid, which they say is short-lived, disease prone and yields poorly under the part-time management usual among smallholder producers. Many smallholders spend time on subsistence agriculture and community activities and are not full-time cocoa farmers. The BCCRP hybrid is therefore arguably less suited to the Melanesian smallholder lifestyle. There are reports of farmers reverting to ‘colonial’ varieties from seeds sourced elsewhere in Bougainville.

### 3.4.3 BCCDRP cocoa dryers

The primary objective of BCCDRP was to rehabilitate the existing dryers and distribute new cocoa mini-dryers. Figure 29, colour coded by economic region shows the

**Table 21. Fermentaries on register compared to dryers distributed by BCCDRP**

Cocoa District	Registered mini dryers	Registered other dryers	BCCDRP mini dryers distributed	BCCDRP other dryers rehabilitated	Proportion of known dryers registered (%)
<b>North</b> (Buka, Selau/Suir, Tinputz, Kunua)	427	469	529	564	82
<b>Central</b> (Wakunai, Arawa)	129	173	381	360	41
<b>South</b> (Buin, Siwai, Bana, Torokina)	124	217	531	386	37
<b>Total</b>	<b>680</b>	<b>859</b>	<b>1441</b>	<b>1310</b>	<b>56</b>





**CCEA cocoa seedlings nursery, Buka; Cocoa pods ripening, Kopani**

distribution of cocoa dryers (both rehabilitated and mini-dryers, Phases 1 and 2 combined) by district.

In terms of economic region, the distribution approximately complemented the distribution in Figure 27 of cocoa seeds and seedlings by the BCCRP. This distribution is compared in Table 20. There seems to have been no explicit strategy of matching crop processing capacity by BCCDRP to the tree stock renewal by BCCRP, although the overall outcome was fortuitous.

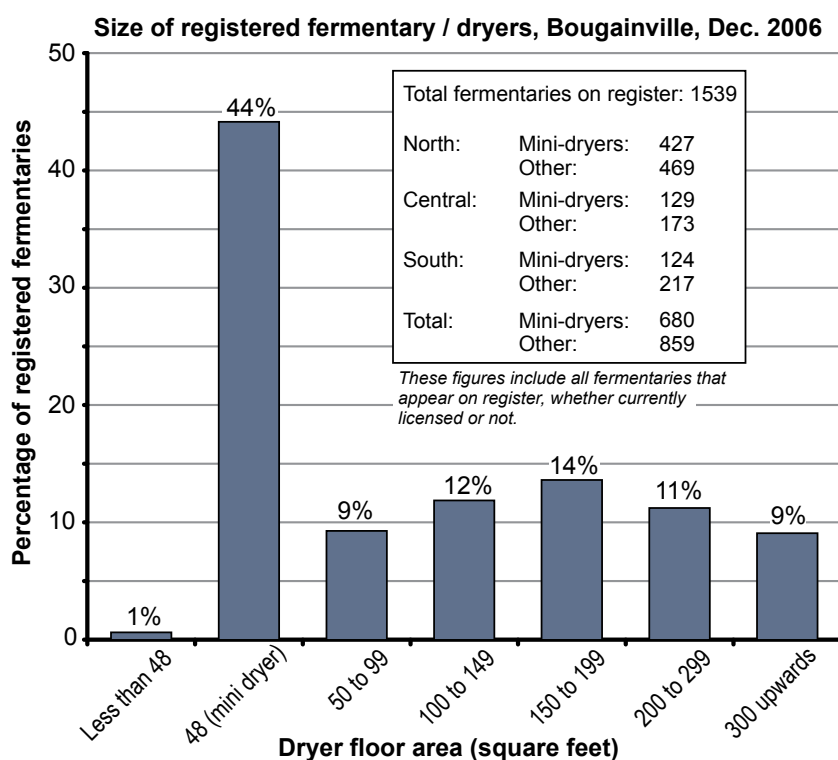
Distribution of BCCDRP dryers per household by district is shown in Figure 30. Also plotted is the distribution of BCCDRP trust fund projects per household.<sup>74</sup> In this chart, the districts most advantaged by BCCDRP have the lowest score of households per project. The chart shows that overall the districts of the northeast economic region benefited most from the project, while Buka was most deprived.

#### *Mini-dryer regulation and cocoa quality concerns*

The use of mini-dryers in Bougainville has met resistance from the Cocoa Board and from other sources. Concerns that the misuse of mini-dryers was causing a decline in Bougainville cocoa quality were aired in 2005, and a ban was temporarily imposed on use of the BCCDRP mini-dryers.<sup>75</sup> The ensuing controversy instigated a cocoa quality survey by ABG Division of Economic Services. The cocoa quality survey concluded that Bougainville's cocoa quality has remained high and that the mini-dryers were not producing low quality cocoa. This is consistent with the assertion of Agmark Pacific, the largest exporter, that there is no quality problem and may suggest that the industry can manage cocoa quality without expensive oversight of the Board. However, there is still concern by the Board and its supporters about the adequacy of crop processing rehabilitation and the capacity of the cocoa industry's institutional framework to cope with the rise in number of fermentaries operating in Bougainville.<sup>76</sup>

Figure 31 shows that the number of dryers recorded on the Cocoa Board fermentary register. The registration of many of these has currently lapsed. Table 21 further shows that the number of fermentaries on the books is less than the number of dryers provided by BCCDRP, particularly in Central and South districts. This non-compliance has caused the Cocoa Board to see BCCDRP as the cause of problems, first for distributing dryers without licensing (this being a condition of distribution) and second, because unregistered dryers are feeding the cocoa grey and black markets.

Early on during BCCDRP, the Cocoa Board realised it would struggle to properly supervise the quality of production with the proliferation of small dryers, often in



Source: Fermentary registers for north, central and south Bougainville, 2006-07. PNG Cocoa Board, Buka Office.

**Figure 31. Number of fermentaries on register by size and by cocoa district**

remote locations. This was in contrast to the pre-crisis years when cocoa processing was restricted to large centralised dryers owned either by the private plantations or by smallholder cocoa cooperatives both of which obtained their wet beans from smallholder cocoa growers. The owners of private plantations kept the income from drying the beans, while the cooperatives that supposedly distributed its profits among its smallholder members are remembered in Bougainville for their corruption and mismanagement.

By the time BCCDRP was set up, both the plantations and the cooperatives had ceased to exist. The Cocoa Board and some ABG members argue that cocoa processing should be centralised as before, to make the Cocoa Board's cocoa quality inspection more efficient. Conversely, the distribution of hundreds of mini-dryers among producers has decentralized the profits from bean processing, to the smallholder's advantage.

The owners of mini-dryers are now unwilling to give up their improved economic circumstance that has accompanied their new position as grower-producers and will not return to the pre-crisis days when they were lowly wet-bean cocoa peasants on the margins of a feudal-style plantation system. However, the argument has not ended; Cocoa Board hopes to resurrect the cocoa cooperatives and nuclear estates and induce more growers to use larger central drying facilities that are easy to inspect. It maintains that the BCCDRP mini-dryers have impeded its inspection and regulatory functions necessary for ensuring product quality. To this is added the difficulty encountered by the Cocoa Board to cope with the cowboy trade as discussed earlier in Section 3.1.3 that has emerged in the aftermath of the distribution of unregistered mini-dryers by the BCCDRP. To some extent the inspection and quality concerns are also driven by industry politics where the Cocoa Board's previously central regulatory role has been displaced by decentralised small dryers, deregulated buyers and quality grading by exporters.



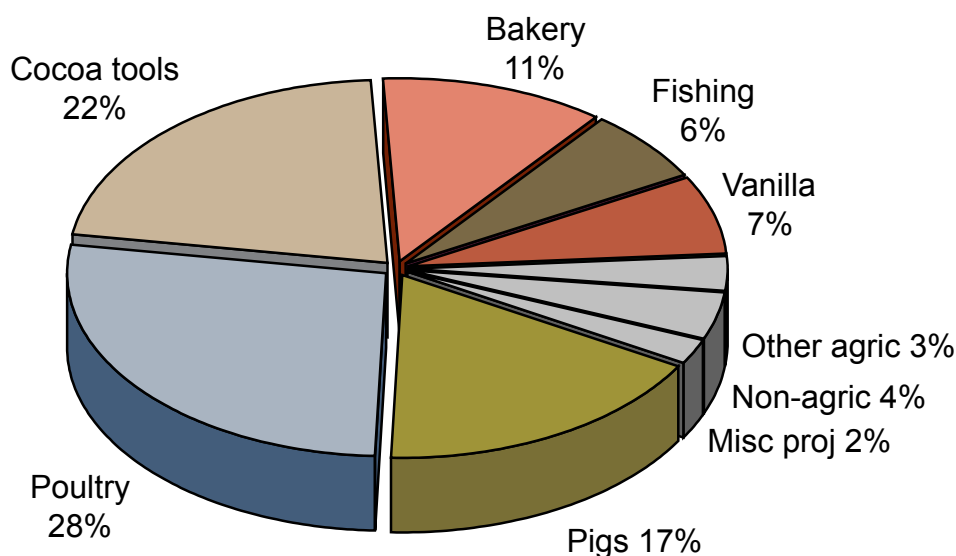
**BCCDRP mini dryer, Kopani; Cocoa beans spread on mini-dryer bed**

Other losers in the new order are the previous oligopoly of plantation owners and entrepreneurial clan dons, among whom support for the Board is strongest.

A second issue surrounding mini-dryers is that of authorised usage. Mini dryers were issued on Cocoa Board's proviso that the licensed owner of a mini-dryer would only use the dryer themselves and only to dry cocoa they themselves had grown. The size of the dryer was matched to the typical yield of a one hectare cocoa plot. In reality, there are far more growers than mini-dryers and most growers are closely related to at least one mini-dryer owner. In Bougainville, smallholder plots are under customary jurisdiction of the clan. Clan obligations include assistance to relatives, at least with the expectation of reciprocal help in the future. Mini-dryer owners cannot then act entirely as economic individualists and the dryer facility is shared by a number of neighbouring smallholders, typically four to six, with the owner acting as manager. The dryer owner may buy wet beans from other smallholders or share the dryer in a 'round' system with the different relatives taking turns to dry their cocoa. This behaviour is closely linked to cultural fundamentals within Bougainville, so that the current regulations in this respect are unrealistic.

From a technical standpoint, the use of each mini-dryer by a group of smallholders has caused capacity problems in the drying process. Referring back to the project design (Section 2.4), BCCDRP dryers were the 8ft x 6ft mini-dryer size, as developed some years earlier by CCRI in East New Britain.<sup>77</sup> The fermenter boxes, built to match the dryer, were to have a capacity of 200kg, as against the 'standard 1000kg box' which the design team deemed inappropriate for small growers.<sup>78</sup> A 200kg load of wet bean produces about one bag of dry bean on the dryer bed.

An understanding of overall dryer capacity in Bougainville puts the capacity issue discussed here in context. Comparing dryers registered against dryers distributed and taking the higher figure for each district, a total minimum number of dryers in each district can be derived. The sum of these is a conservative estimate for the number of dryers in Bougainville, just under 2,900. About half of these are mini-dryers. Measured by dryer mesh area however, mini-dryers account for only about 20 percent of total mesh area in Bougainville. Working with the estimated production figures in Section 3.1.3, overall average annual yield per dryer is just over five tonnes, while for mini-dryers, it is about two tonnes per dryer annually (although this varies from over 9 tonnes in Tinputz and Wakunai to just 1.5 tonnes in Buin). The worksheet for arriving at these figures is provided in Annex 5. In contrast, Omuru (1997) reporting on field trials for similar mini-dryers indicates that nine rounds through the dryer, yielding about 800kg (13 bags)



**Figure 32. Trust fund project types, phases 1 and 2**

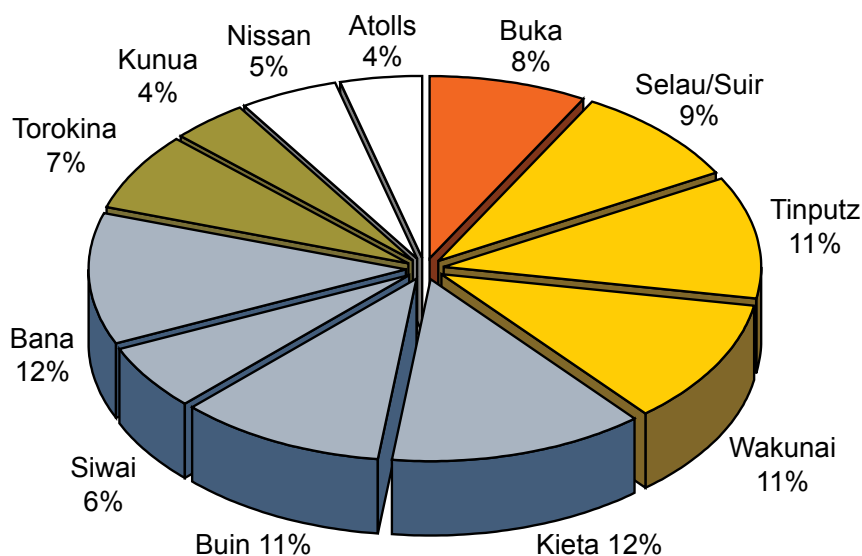
annually, is a suitable rate of use.<sup>79</sup> Mini-dryers in Bougainville appear to be producing much more than this, suggesting over-use particularly in the high yield districts.

While cocoa pods mature for harvesting throughout much of the year, most cocoa matures during the flush periods, the ‘main flush’ and the ‘mini flush’. At these peak periods, heavy demand is placed on dryers. While the owner can discuss a harvesting schedule with the other users and so manage this demand somewhat, mini-dryers are essentially undersized for peak production processing. It creates a bottleneck which is often solved by not fermenting the beans long enough in the fermenter boxes and not drying the cocoa long enough on the dryer mesh, before the next person’s cocoa is put through. The Cocoa Board sees this as malpractice while DPI views it as an issue of carelessness by producers. On the other hand, smallholders see it as the side effect of providing undersized, one-size-fits-all dryers to what was always going to be used as a group utility, rather than an isolated individual asset.

Many mini-dryer owners have ambitions of replacing their mini-dryer with a larger dryer (often 8ft x 12 ft is mentioned, which is still relatively small) or augmenting the mini-dryer with another small dryer nearby to be used only in peak periods.<sup>80</sup> In an example of how the use of such facilities are organized, one clan leader in Rotokas (upland Wakunai), acting as a manager of dryer work distribution, views all the dryers on his clan land as a network and allocates smallholders to certain dryers during peak production periods. This clan has one larger dryer and a number of mini-dryers between them, each in the charge of an owner and, each owner autonomous to some extent. The work of the clan leader in managing this situation is one of negotiation rather than command. The social context of dryer use points to the need for a mix of dryer sizes ranging from mini (48 sq.ft.) to ‘midi’ (up to 150 sq.ft.), depending on spatial variations in yield.

Evidently little attention was given by BCCDRP to the social context of dryer usage as described above. In its defence, BCCDRP saw mini-dryers as cheaper than larger dryers so that there could be more of them and they could be dispersed more widely to target women, the poor and remote beneficiaries. However, local informants question the degree to which mini-dryers were distributed equitably to the remote areas as opposed to the areas near the road. As the BCCDRP did not compile distribution data by location, this can neither be confirmed nor disputed. Distribution of dryers to women is discussed below.





**Figure 33. Distribution of trust fund projects by district, phases 1 and 2**

It is important to note that the difficulties created between the Cocoa Board and smallholders through the introduction of many hundreds of small dryers will increase as the BCCRP cocoa trees move into peak yield in the next few years. The reason is that the peak in cocoa production will coincide with the retirement of many mini-dryers due to rusted-out furnaces. A doubling of dryer capacity is quickly required.<sup>81</sup> It is also worth noting first, that growers aspire to independent grower/producer status, second, that growers act within a network of clan reciprocity wherein the one dryer – one grower rule is unfeasible and third, that overall productive capacity measured in mesh area per district, will have to increase.

Two solutions are apparent: 1) work with Cocoa Board to resurrect large cooperative dryers although these entail problems mentioned earlier, and 2) work with clan-based organisations where possible, to install peak-load dryers. The latter may best be achieved through credit or savings schemes available to smallholders. The Cocoa Board too may need to explore ways to increase its inspection capacity in remote areas through the support of the ABG district agricultural officers and the members of the Councils of Elders. The importance of social organisational factors and institutional support arrangements must stay at the forefront in an infrastructure roll-out.

#### *Metal manufacturing aspects*

The BCCDRP commissioned the metal workshops in Bougainville to fabricate mini-dryer fermenting boxes and cocoa dryers. Among the items produced were wooden components for dryer frames and beds, dryer mesh and steel furnace pipes, flue pipes and sheet metal cladding for dryers. Parts were also produced for repairing the cocoa dryers. The manufacturers in Phase 1 were Buka Metal fabricators (Buka), Ateik Engineering (Arawa), South Engineering (Buin), and South Bougainville Research and Training Centre (Siwai). Phase 2 added Pemana Ltd (Buka), Geetow Welding, Tinputz STC, and Siawe Youth (Bana) in Phase 2 to this list.<sup>82</sup> There are no records of the numbers employed in these workshops during BCCDRP, but if each workshop is estimated to have ten employees, then in Phase 1, about 40 jobs were generated rising to about 80 in Phase 2. The commercial fabricators listed are still operating and now produce various agricultural, structural and engineering items. However, the training-based workshops are less active.



**RDTF piggery in Tinputz; RDTF drum oven operating in Torokina**

Many of the dryers have now been in use for a number of years and the furnaces and flues are rusting, requiring replacement. While this has not deterred the owners from operating the dryers anyway, it is against Cocoa Board regulations to use dryers in such disrepair as smoke can enter the drying chamber, tainting the beans. Clearly, all 1,750 or so dryers repaired or distributed new by BCCDRP will require refurbishment soon. Metal fabricators contacted by the study claim difficulty in sourcing the sheet metal for fabricating the components; also dryer owners are not keen on paying for repairs. As there was no provision for ongoing refurbishment in the BCCDRP, the issue may now need to be addressed as market forces may not stimulate an appropriate private sector response.

### **3.4.4 BCCDRP Trust Fund**

In Figure 5 of Section 1.2.2, secondary or downstream business is identified as part of the strategy of increasing household income as a means toward building peace. In this strategy, smallholder market chain rehabilitation generates income from crop exports. Some of this income may be able to circulate through local businesses, creating a multiplier effect and provide household income for people who seek an alternative to export cropping. Although not clearly stated in the original design documents, this was apparently intended by the BCCDRP Rural Development Trust fund (RDTF).

The RDTF projects covered a wide array of small enterprise ideas among which poultry supplies, piggery materials, cocoa tools, bread-making drum ovens and fishing equipment were most popular (Figure 32). The results have been indifferent. Unlike cocoa dryers, many of the trust fund projects have ceased to operate commercially. Among them, particularly significant is the case of livestock (poultry and piggery) projects for which a large number of critical management factors were required. It was observed that projects which required little management (cocoa tools, drum ovens, fishing equipment) have survived, even though the equipment provided has not always been fully utilized. Vanilla projects were established when market prices were high even for second grade vanilla, but growers appear not to have the expertise to produce first grade bean, which is the only grade for which an export market currently exists. Effectively Bougainville growers cannot now sell their vanilla.<sup>83</sup>

Relative distribution of projects by districts for both phases 1 and 2 is shown in Figure 33. As with the cocoa dryers, the districts of the northeast were favoured over the others. In the offshore island districts of Nissan and Atolls, where cocoa does not grow well, more trust fund projects than cocoa dryers were dispensed.



## Piggeries

Piggery materials supplied by BCCDRP consisted of a roll of fencing wire mesh. Piggeries are simply an open yard and small shelter surrounded by wire. Bougainville society has a long cultural association with pigs, which are a festive part of weddings, religious festivals, reconciliations and funerals. In most of Bougainville, pigs have traditionally roamed free-range, with occasional supplementary feeding.

Stall-feeding pigs is not a part of Bougainville culture especially as pigs must then be fed root crops grown for the family. Thus pigs continue to roam freely around many villages and only those being fattened for imminent slaughter or sale are held in pens.<sup>84</sup> BCCDRP piggery enclosures are often empty except in the lead up to feasts at weddings, funerals or Christmas. The accompanying photograph shows a family piggery in Tinputz where unused BCCDRP enclosure wire was bought second-hand and small pigs are being fattened for sale.

Unlike cocoa, piggeries are not viewed as a source of cash and employment, but an adjunct to the social life of a household, helping to fulfil customary social exchanges. However when pigs are raised for sale, they fetch from K300 to K900 depending on their size. Decisions concerning the rearing of pigs are based on how much feed is available for fattening them and their requirement for the household's customary obligations. The low sales of commercial pig feed pellets in Bougainville suggests that very few BCCDRP piggeries have commercialised. However, even while the BCCDRP piggeries have had little cash impact, they were popular and have complemented the traditional festive system in building post-conflict social capital among villagers.

## Poultry

BCCDRP poultry projects were not commercially successful. Most poultry projects consisted of the provision of broiler chicks and the various commercial pellet foods required for raising the chicks into mature broilers for slaughter. A minority of poultry projects concentrated on layer hens, and a tiny number raised ducks instead of chickens. Managing the supply logistics was time consuming and difficult for BCCDRP. In some cases the chicks supplied were dead on arrival, as they were sourced in Lae and air freighted to Buka. Where flights were delayed or Buka-bound cargo offloaded *en route*, the chicks died. At other times the chicks arrived, but the commercial feed required

**Table 22. Tree seedlings grown and distributed, by district**

DISTRICT	Nr Tree Seedlings Phase I	Mini-Dryers Phase I	Seedlings per Dryer Phase I	Nr Tree Seedlings Phase II	Mini-Dryers Phase II	Seedlings per Dryer Phase II
BUKA	32,294	77	419	60,672	60	1,011
SELAU/SUIR	3,010	71	42	2,120	116	18
TINPUTZ	10,000	80	125	0	71	0
WAKUNAI	0	112	0	0	57	0
KIETA	6,330	122	52	87,373	69	1,266
BUIN	102,661	83	1,237	110,950	19	5,839
SIWAI	11,390	109	104	0	12	0
BANA	33,000	58	569	0	56	0
TOROKINA	0	43	0	0	6	0
KUNUA	0	26	0	0	63	0
UNKNOWN	-	-	-	10,475	-	-
TOTAL	198,685	781		271,590	529	



**BCCDRP hardwood tree seedling nursery in Buka; BCCDRP teak plantation in Buka**

was not available. In the absence of commercial supplies, many poultry growers raised just one or two batches of hens before dispersing project resources. In other cases, the chicken houses that were built for the poultry projects are used occasionally, to buy in chicks for rearing in time for Christmas sale and slaughter. These intermittently operated projects although not commercial, do supplement household income.<sup>85</sup>

A lesser number of poultry projects were for egg production. Production costs of eggs after input costs (layer chicks and pelletised feed) are deducted are only marginally lower than the price at which the eggs are sold. The price of eggs in Bougainville is depressed by cheaper imports from Lae against which local farmers struggle to compete sustainably. One such farmer in Arawa said that most egg projects had closed down.

#### *Cocoa tools*

Cocoa tools were in demand post-crisis for rehabilitating smallholder cocoa plots, which involves pruning to open the canopy to sunlight, pest control and weed control. Pruning tools include a bowsaw, secateurs, a chupon knife and a long-handle pruner, while knapsack pressure sprayers are often used for pest control. 600 sets of cocoa tools, apparently of the types noted above, were distributed under the RDTF. These have been used effectively to increase cocoa yield, but given that in Section 3.1.3 it is estimated there are about 24,000 cocoa smallholders in Bougainville many among whom need such tools, the impact would have been almost undetectable.

#### *Mixed success of the RDTF*

As noted, RDTF livestock projects proved to hold logistics challenges beyond the capacity of BCCDRP or the beneficiaries to overcome. Although some of these projects are being used part-time for supplementary income or as part of the subsistence (non-cash) economy, the high overall rate of failure reported points to the conclusion that the livestock part of RDTF must largely be written off. In addition, vanilla projects have produced no returns, for reasons partly beyond the BCCDRP's control.<sup>86</sup> This leaves those projects which were hardware based. Cocoa tools as noted, fed into export crop production rather than establishment of downstream businesses. Referring back to Figure 32, it is just the remaining one quarter of projects distributed, including drum ovens, fishing equipment and a scatter of varied business ideas that may have succeeded.

The conclusion, based on field interviews is that in those districts where gross per capita income from export crops is low, these remaining projects have not done well. They have either failed or are operated part time to supplement income or are absorbed fully into household subsistence. In the higher income districts, some of these projects have

succeeded. In Arawa, some of these successful business people were interviewed. One woman is doing well as a travelling saleswoman, selling clothes she dyes in cocoa-rich Wakunai villages. Another couple produce and sell eggs in the Arawa urban retail market. In cocoa-rich Tinputz, one drum oven was seen producing bread for sale through the family roadside retail store.

### 3.4.5 Firewood Tree Seedlings

‘Firewood tree seedlings’ was a stand-alone component of BCCDRP Phase 1 and 2. It was projected that the copra and cocoa dryers would pressure the local timber resources reserved for house construction or which are eco-systemically valuable. BCCDRP proposed to counter this by distributing twenty firewood replacement seedlings with each dryer.

Tree seedlings were grown as tubestock in nurseries set up under the BCCDRP (see accompanying photograph). BCCDRP reported that in Phase 1, almost 200,000 forestry seedlings were established in nurseries, with just over 117,000 distributed to farmers. In Phase 2, BCCDRP reported that 32 tree nurseries were set up and over 272,000 seedlings were distributed and planted as part of the mini-dryer package. Table 22 shows the number of tree seedlings grown and distributed per district.<sup>87</sup> More than 470,000 tree seedlings were grown and distributed over the life of the project. The activity appears concentrated in patches rather than distributed across Bougainville. Buka, Kieta (Arawa) and Buin districts in particular were very active, while other districts received few or no seedlings. Thus, the distribution of 20 seedlings with each dryer was uneven across districts and in one instance almost 6,000 seedlings were distributed per dryer (Table 22).

After some delay in finding a workable management system, the tree nurseries were administered by the Buka office of the National Forestry Service (NFS) in Phase 1. At some point in Phase 2, BCCDRP began directly administering the nurseries, after acrimony with the National Forestry Service over the running of the activity. In part, the disagreement was over the implementation strategy stemming from the original objective which sought to increase both future firewood and timber for building supplies. BCCDRP apparently saw this objective as tied directly to the mini-dryer program, wherein the mini-dryer owners would grow the trees and the species grown predominantly for firewood. The National Forestry Service regarded this as impractical as the mini-dryer owners would not necessarily be committed to tree growing. Instead

**Table 23. Species grown in BCCDRP tree nurseries, 2003**

NURSERY	DISTRICT	SPECIES
Moma	Buin	<i>Eucalyptus deglupta</i> , <i>Albizia</i> spp, Black bean (? <i>Castanospermum</i> ?), Balsa, <i>Vitex</i> , <i>Terminalia brassii</i> , <i>Gmelina</i>
Mongai	Buin	<i>Albizia</i> spp, Balsa, <i>Planchonella</i> , <i>T.brassii</i> , <i>Gmelina</i> , <i>Vitex</i> , Pencil cedar
Simon Lepo	Siwai	<i>E. deglupta</i> , <i>Calophyllum</i> , Pencil cedar, <i>Vitex</i> , Walnut
Sikutai group	Buin	<i>E. deglupta</i> , <i>Gmelina</i> , <i>Vitex</i> , <i>Albizia</i> spp, <i>T. brassii</i>
Wisai - Oria	Koromira	Balsa, <i>Gmelina</i> , <i>Vitex</i> , <i>T. brassii</i>
Kubu	Buka	Balsa, <i>Gmelina</i> , <i>E. deglupta</i> , <i>Octomeles sumatrana</i> , <i>Albizia</i> spp, <i>Vitex</i>
BCCDRP		
Hanahan	Buka	<i>E. deglupta</i> , <i>Gmelina</i> , Balsa, <i>Vitex</i>
Malasang	Buka	<i>E. deglupta</i> , <i>Gmelina</i> , Balsa, <i>Vitex</i>
Teabes	Tinputz	<i>E. deglupta</i> , <i>Gmelina</i>
Kekesu	Tinputz	<i>E. deglupta</i> , <i>Gmelina</i>

Forestry saw tree growing as an activity best achieved through growers specialising in plantation forestry of species for commercial construction purposes.

BCCDRP reporting tended to emphasise the large numbers of trees grown in the nurseries. The completion report highlighted the success of the component in its summary, although the report detail observed that:

- Not all farmers with [mini-dryer] processing facilities were interested in tree planting
- Farmers regard trees planted more as a resource for commerce or building than firewood, which they regarded an infinite resource
- Trees supplied were not well maintained, being low in the farmer's priority.<sup>88</sup>

In Tinputz, the district agricultural officer at the time of the BCCDRP reported to the study that tubestock tree seedlings delivered with each mini-dryer would often remain unplanted and eventually die in the tubes. This corroborates the National Forestry Service's view that tree growing should have been seen as a distinct and specialized activity.

The estimates by BCCDRP of trees established on farms are at variance from those of NFS. The completion report notes that of the Phase 2 distribution of 272,890 seedlings, 78.6 percent (214,450 seedlings) survived to 8 months and 114,500 seedlings grew into trees. NFS observed that only about 5 percent of the BCCDRP seedling stock matured as trees, although this estimate may be on the low side.<sup>89</sup> The bulk of these were grown not by dryer owners for firewood, but by tree growers in plantations as timber for construction or commercial harvest. According to NFS, this occurred mainly in Buka and Buin. The species grown are indicated in Table 23.<sup>90</sup> Other than the softwood shade species *Albizia*, all others are commercial species and/or species used locally for modern house-building. Contrary to design, firewood usage was not preferred.

When asked what sorts of timber was used as firewood for the dryers, farmers pointed to *Macaranga*, *Trema*, *Kleinhovia* and other pioneer tree species, abundant in secondary and open disturbed forest and common as young regrowth around the edges of garden clearings. These colonizers grow rapidly, yielding a soft low density timber and are often cut down and burnt when clearing for a new garden. When farmers were asked if they used the denser old-forest timbers in the dryers, such as the construction timber *Vitex cofassus*, they replied that such dense timbers burn too hot in the tiny furnace of the mini-dryers and burn holes through the metal. Hence forest hardwoods are avoided.

A possible reason as to why this was not anticipated in the BCCDRP was given by the Tinputz agricultural officer who said that prior to BCCDRP, few if any in Bougainville had used a mini-dryer. The big commercial cocoa dryers consumed hardwood and with little opportunity to pilot the mini-dryers before planning the firewood seedlings component, it was assumed that their fuel requirements would be the same as for the larger dryers. It was only retrospectively that people found that the abundant soft regrowth species were better for the mini-dryers.

There were other factors that came in the way of the seedlings project. Particularly at establishment, much work is required to keep plantation trees clear of climbing vines (e.g. *Merremia* spp.) that otherwise quickly strangle the saplings. Such effort is unlikely to be wasted on trees destined for firewood. The view taken in the BCCDRP of tree planting as a casual adjunct to the core business of cocoa processing is surprising in the light of the available knowledge about tree farmer practices in Melanesia. Forestry tree growing is a distinct smallholder enterprise in other parts of Melanesia, with growers



**The busy Arawa town market; Well-stocked roadside store, Wakunai district**

establishing a tree plot typically about 1 ha area, or as a group to grow a larger plot (see accompanying photograph).

There is little evidence of a clear firewood tree planting strategy in the BCCDRP project documents. The National Forestry Service had advised treating the seedlings project as a separate activity to be undertaken by specialist growers arguing that very few cocoa farmers in Bougainville had the inclination to raise trees. This was rejected by the BCCDRP which instead distributed 20 seedlings with each mini-dryer making it the individual responsibility of the dryer owners to replace the harvested trees. Generally, the trees planted by the mini-dryer owners have not been properly maintained and the overwhelming evidence is that the impact of the firewood tree seedlings component has been insignificant.

### **3.4.6 Overall impact of BCCDRP**

Overall the impact of the BCCDRP, especially the cocoa dryer projects, was high. This success was tempered by regionally uneven impact and the generally lower success of the trust fund in establishing downstream businesses.

#### *Local economy*

The impact of the BCCDRP on the local economy from the crop dryers have differed markedly from those realized from the trust fund projects. The success of crop dryers, which during implementation became an almost exclusive focus on cocoa dryers, was heavily dependent for its overall success on efforts at rehabilitating the cocoa trees by the UNDP/EU/AusAID funded BCCRP. Without the high cocoa yields of the BCCRP, the dryers would have been underutilised. Further, the freight path created by the rehabilitation and maintenance of the trunk road was a significant factor. Also contributing to its success, the BCCDRP fed into a society that was accustomed to smallholder cocoa production and it was building on existing strengths. With these provisos pertaining to the dependency of the dryer project on other factors, the cocoa dryer projects progressively increased smallholder incomes.

As noted elsewhere, the economic impacts vary geographically, with remote areas not fully benefiting from the cocoa dryers. This includes the mountainous areas especially those in the potentially high yielding areas of the northeast highlands which while receiving the dryers, have been constrained by poor feeder road access to the trunk road. Significantly, the high potential yield district of Torokina received many dryers but these are not being fully utilised because of the lack of transport.



BCCDRP trust fund projects have had a modest to low impact on the local economy in most parts of Bougainville. A number have failed to be commercially successful due to logistic factors or because of their inappropriateness (see 3.4.4). Logistic factors have relegated many piggery and chicken projects to the level of occasional activities, or forced them to cease altogether. Many trust fund projects are underutilised due to their exclusive dependence on local markets for outlets. Often, these markets are unable to support the volume of the goods produced. The situation is more buoyant in the northeast and Buka where some projects have done well. In these near road areas where more cocoa cash or urban demand exists, more goods can be sold. Proximity to towns has also facilitated access by livestock projects (poultry in particular) to commercial feed or hatchlings. Vanilla projects for which favourable conditions existed in the south failed when demand ceased for lower grade PNG vanilla sometime after BCCDRP had distributed these projects.

### *BCCDRP cocoa dryer impacts on poverty and gender*

The BCCDRP intended the dryer projects to reach the most disadvantaged members of society, including ex-combatants, people in remote areas, and women. One informant noted a change of mentality around 2004, when men began to lose their identity as 'ex-combatants'. She noted that many have taken on newer social roles and activities which have helped them to progress beyond the expression of wartime grievances that dominated the immediate post-conflict period. The political role of organisations such as the BRA has also diminished. Many of the young men and women have married, built new houses and hamlets, established families and taken to cocoa growing. This is particularly noticeable in the north, where the transition has been facilitated by smallholder income from cocoa. As a result of the change in attitude, by late 2006 it was difficult to identify who was, or was not an 'ex-combatant'. This transition is not visible in the south.

On the issue of gender, informants were asked if the mini-dryers distributed to women applicants were still under their control. The question drew two types of responses, from approximately equal numbers of people. Some said that control of the dryers has been taken over by 'strongman' male relatives; others asserted that control had remained with women because of the high status accorded to women in Bougainville's predominantly matrilineal society.

Matrilineal descent is the norm for all of Bougainville apart from Buin, which is patrilineal. Successors (male and female) in customary political leadership establish their primacy within the clan through their female ancestors. Matrilineality does not of itself confer status to women, an example of which is that of neighbouring Western Solomon Islands, where matrilineal kinship is simply the rule by which men distinguish which other men can receive power (e.g. who is eligible to be clan chief).

However, the difference in Bougainville is the rule of matrilocality, which is widely (but not exclusively) followed. A married couple live on the wife's land and their children inherit land rights from the mother's clan. Conversely they inherit no property through the father. However, if the family buys a block of land from the husband's clan this may then be inherited by his children under custom. For the most part however, matrilocality tends to see the husband moving to the wife's clan area where he is treated as a mere in-law or *tambu*, respected, but essentially powerless in the clan's affairs.

Over time, a clan residential group consists of sisters married to sets of husbands who are powerless in clan affairs. Thus, a husband may assume control of the dryer within the household, but as it is located on clan land, the clan recognises the wife's right to its





**Mini dryer owned by matrilocal clan women, Rotokas area, Wakunai; Tie-dying micro-enterprise, Arawa. RTDF projects succeed better near towns and in areas where the primary income from cocoa is higher**

use, not his. Complex patterns of social organisation can arise around the interaction between these two aspects of dryer usufruct.

The control of women over dryers is determined in a unique way through the interweaving of clan structure and interactive political agency. Even if a woman is reluctant to establish individual claim over a dryer (most say it belongs to them *and* their husband), she may or may not cede control over it to her husband. What is certain is that she cannot be dispossessed of it while it is located on her clan land. Some women assert a high degree of control, while others follow the husband's lead. For many, a more important matter is the income from the dryer and how it is used.

From a gender perspective, an important issue concerning the household cocoa economy is about who actually sells the cocoa and controls the money. As a matter of general practice, men transport cocoa to the market. Many women are heard talking about other women's husbands or sons who spend the proceeds from cocoa sales on alcohol in Buka, to return home empty handed. Others talk of their own husbands who bring back the proceeds for household needs and children's school fees. The prevalence of one or the other behaviour type often depends on the quality of leadership within the clan. However, if men transport cocoa it can lead to the disenfranchisement of women.

Interestingly, on the Togerau feeder road in Wakunai - which is one of the few feeder roads to have been rehabilitated - spot buyers drive to the grower areas and women sell the cocoa directly. Feeder road augmentation may prove an important means through which more economic control by women can be secured.

#### *RTDF impacts on poverty and gender*

In contrast to the cocoa dryer projects, it is difficult to locate women who benefited from the trust fund projects. Where these projects have survived, they are operated to occasionally supplement household income. Most projects secured by women are generally still operated by them. This is particularly the case for sewing machine and baking oven projects.

As the trust fund projects generally relied on domestic sales, their success depended almost wholly on local incomes. One bakery operator in Torokina said she sells her

goods only during festivals as the locals are too poor even to buy the morning buns so popular in villages across island Melanesia. For operators with good access to the retail areas and large markets in Buka and Arawa, the opportunities for baked goods, or store sales of locally sewn clothes such as *mere* blouses and school uniforms are more promising.

Trust fund projects delivered to women with some minor exceptions have not provided full-time income, but supplemented their earnings from cocoa. The pig and poultry projects have been hampered by the logistics of obtaining pig and poultry feed and the supply of chicks. Consequently, many of these have evaporated. Other projects such as bakeries and tailoring have suffered because of low demand.

There were no direct cumulative impacts noted from interaction between the dryer and trust fund projects, although as noted earlier the general rule holds that where cocoa production has been raised, disposable income for microenterprise patronage is greater.

### **3.5 Conclusions of the social impact evaluation**

This conclusion to the social impact evaluation answers three of the key questions raised in the introduction to this study:

- What were the combined impacts of Australian assistance to agriculture and transport infrastructure on social and economic activities;
- Was Australian assistance to transport infrastructure and agriculture an appropriate intervention at this stage of the peace process;
- Were there ways that these projects could have been delivered more cost effectively?

The fourth question, “did the quantifiable economic benefits of the Australian assistance to transport infrastructure and agriculture on Bougainville outweigh the costs?” is answered by the cost benefit analysis of Section 4. The first of the key questions is answered by testing the proposition that smallholder market supply chain rehabilitation, of which the AusAID roads, wharves and agriculture projects were a significant part, raised household income levels and contributed to peace-building. The following two key questions are addressed in Sections 3.6.2 and 3.6.3.

#### **3.5.1 Combined impact: testing the SMC model of peace-building**

The impacts of the individual RWA projects have been identified in the preceding sections. It remains here to evaluate combined impact, in answer to the first key question in the introduction to this study, “what were the combined impacts of Australian assistance to agriculture and transport infrastructure on social and economic activities?”

The introduction to this report (Section 1.2) outlined a thesis that post-conflict restoration of the smallholder market chain (SMC) was one of three necessary areas of intervention for peace building in a rural society such as Bougainville. The implicit assumptions were that it would do so by generating household income either directly from receipts to smallholders for their export crops, or from local businesses that rely on sales within the local markets fed by export crop income.

Assuming that civil society and governance interventions are successful and household income generated from export crops is widespread and sufficient to alleviate poverty, the model predicts that people will turn from conflict to a growth orientation to establish

**Table 24. Smallholder market chain socio-economic impact matrix**

District	Gross agricultural income per capita (K) 2006	Gross cocoa income per capita (K) 2006	Cocoa production share (%)	Share of total cocoa trees (%)	Cocoa tree productivity	BCCDRP cocoa dryers distribution (%)	BCCDRP dryer productivity	Proportion of region's population within 7km of road (%)	Underlying conditions	Broken links and downstream effects	Main alternatives for income
Buka	214	109	8%	11%	0.8	9%	0.9	100%	Low cocoa potential ; High transport access	Limited cocoa yield ; Good secondary business development (due to proximity to Buka town)	Copra; town jobs (Buka); town produce markets; coconut oil fuel production (emerging)
Northeast	1003	994	58%	33%	1.8	36%	1.6	81%	High cocoa potential; good transport access	Good secondary business development but land tenure preventing central-place development; Feeder roads a problem inland	Local businesses; town markets (Buka, Arawa), limited district produce markets
West coast	385	309	9%	13%	0.7	8%	1.1	62%	High cocoa potential ; Poor transport access in Torokina	Poor transport for cocoa in Torokina ; little secondary business development	Poor
South	148	144	25%	44%	0.6	47%	0.5	74%	Low cocoa potential ; Moderate transport access ; premature withdrawal of peace-keeping	Low cocoa yield; Feeder roads a problem inland ; little secondary business development	Generally poor. Limited town jobs (Arawa), town and district produce markets; outmigration
Bougainville overall	332	299	100%	100%	1.0	100%	1.0	80%	High overall cocoa potential; established cocoa market; copra as secondary crop; extensive existing trunk road alignment close to people crops and export wharves; wharves adequate although rundown	Vital agricultural wharves not rehabilitated; Lack of assistance to cocoa regulatory systems ; other cash crop options still undeveloped; political consequences for ABG of uneven development	Limited government employment and town work; works schemes (e.g roads); downstream businesses and local produce markets; remittances from circulatory labour migration

peace and build further collective and private benefit. This is put to the test in the following discussion.

### *Indicators defined for combined impact analysis*

The foregoing analysis of impact proceeded first by distinguishing four main economic regions within Bougainville (Section 3 Table 1). The primary finding of this study, based on a careful estimation of export crop production, is the per-capita gross income share across the four economic regions. This can be compared to the impact of the SMC rehabilitation across a range of factors in the matrix presented in Table 24.

The left-hand side of Table 24 summarises a range of numerical indicators across the four regions and Bougainville overall. The derivation and significance of these are now described.

1). **Gross agricultural income per capita.** This has been presented in Section 3.1. As a measure of disparity, it is the key significant finding of the study, as it directly reflects the degree of success of RWA in each region. It integrates two elements:

- the product of estimated copra tonnage for 2006 by the 2006 average fair merchantable store (FMS) price/tonne divided by the estimated 2007 population for Bougainville (excluding Nissan and Atolls) and
- the product of estimated cocoa tonnage for 2006 by the 2006 average delivered-in-store (DIS) price/tonne, divided by the estimated 2007 population for Bougainville (excluding Nissan and Atolls).<sup>91</sup>

The result is an estimate of the gross amount of money handed across the counter by crop dealers to farmers in Bougainville. It does not take into account the freight costs and other costs that farmers bear to take their crop to the dealers, or the price margins the buyers in areas remote from the main markets in Buka and Kokopau might retain.

The measure shows that per capita income distribution from export crop sales is highly uneven across the four districts. The northeast region receives the highest gross income per capita, at just over K1,000, while the south receives the lowest at just under K150. The ratio of difference between these two regions is more than one to six. Buka and the western coast regions also do poorly from agriculture relative to the northeast.

2). **Gross cocoa income per capita.** Cocoa income makes up 90 percent of all agricultural export income. The value for gross cocoa income per capita is calculated as above (the product of estimated cocoa tonnage for 2006 by the 2006 average delivered-in-store (DIS) price/tonne, divided by the estimated 2007 population for Bougainville excluding Nissan and Atolls). When compared against gross income including copra, as in 1) above, copra income appears insignificant except in the case of Buka. The analysis below can be simplified by focusing on cocoa.

3). **Cocoa production share.** The derivation of this estimate was presented in Sections 3.1 and 3.2. It is based on cocoa tonnages from each region. Northeast has the highest production share, with that for south still significant.

4). **Estimated share of total cocoa trees.** This estimate is based on data presented in Section 3.4 and a discussion of its derivation in Section 3.1. The number of cocoa trees now in Bougainville is estimated by adding together 85 percent of the number of viable cocoa trees in 1999 and 85 percent of known BCCRP cocoa seeds and seedlings distributed between 1998 and 2005. This data was available at district level from which the regional shares of the total can be calculated. It shows a concentration of cocoa trees in south Bougainville, *not* the northeast. This was expected.

	Low cocoa potential	High cocoa potential
Low transport access	<b>South</b> K144	<b>West Coast</b> K309
High transport access	<b>Buka</b> K109	<b>Northeast</b> K1003

**Table 25. Regional differences in gross per-capita income for cocoa, by key variables**

5). **Cocoa tree productivity.** This is a key significant finding of the study. The measure divides the share of total cocoa trees by cocoa production share. It is an index to yield in each region. Note that the result inherently takes into account cocoa growing environmental factors, crop processing factors and transport factors. As expected, cocoa trees in the northeast are very productive, while in the south they are not. The significance of this result is that it isolates income disparity to the combined function of cocoa growing environmental factors, crop processing factors and transport factors. The role of each factor in each region is evaluated below.

6). **BCCDRP cocoa dryers distribution.** This was derived in Section 3.4. It shows the share of both mini-dryers and rehabilitated cocoa dryer projects delivered in each region. The shares correlate approximately with the share of cocoa trees in each region. It shows that, in terms of number of cocoa trees, dryers were distributed approximately evenly across Bougainville.

7). **BCCDRP dryer productivity.** This is a significant measure for the effectiveness of the BCCDRP core activity of rehabilitating existing cocoa dryers and supplying new mini-dryers. The project was effective everywhere except in the south.

8). **Proportion of region's population within 7km of road.** This is a significant proxy of effectiveness of the trunk road projects. Derivation of this estimate was presented in Section 3.3. It shows how many people can be regarded as being within the road catchment area. The figure indicates the share of people who can be regarded as having transport access for export crops to market. 7km is regarded as the threshold between those who are within the road catchment and those who are remote. The percentages show that transport access to the road varies between districts. In all districts, the percentages are above 50 percent, indicating that the majority of people now have transport access. However, remote communities are a significant minority.

*Economic impact dependent on fulfilment of cocoa potential and transport access*

It is possible to continue with a quantitative disaggregation of the relative importance of environmental factors, crop processing and transportation access. However, the currently used indicators for potential cocoa yield (Section 3.2) appear erroneous, preventing this exercise from being undertaken. As a substitute, a form of logical framework is used instead. The right hand side of Table 24 qualitatively evaluates the role of the relevant factors. It shows in particular that *cocoa yields, and hence overall levels of household income, were sensitive to the coherence of linkages between each*

*of the three elements of smallholder market chain supply rehabilitation* proposed in the introductory model (Section 1.2, Figure 5).

The theoretically relevant results shown in Table 24 can be summarised in a truth table (Table 25). This truth table assumes that cocoa processing rehabilitation was equally and effectively applied across Bougainville, an assumption that is approximately correct. This reduces the theoretical problem to the interplay of the two key variables: potential for cocoa production and transport access. Table 25 converts the qualitative rankings of 'high', 'good', 'moderate', and 'poor' used in Table 24 into the logic states of either 'high' or 'low', forcing each of the four regions into these categories. Regions are placed into the table accordingly, along with their values for gross cocoa income per capita.

Table 25 shows that ***only where both cocoa potential and transport access is high is gross income also high***. The three other states all return a much lower value for cocoa income. This result vindicates that ***the smallholder market chain rehabilitation model works to increase household income if correctly applied and does not work if incorrectly applied*** (the other possibility was that the theory would not work at all - the result obtained from the test is not a priori self-evident). What has been successfully demonstrated is that ***all three links in the chain: fulfilling cocoa potential by crop rehabilitation, rehabilitation of crop processing facilities and rehabilitation of transport access to market, are essential***.

We now proceed to test the other prediction of the model that high household income will interact positively with the other two main peace-building activities, civil society and governance.

#### *Economic impact interdependent with civil society and governance*

Peace-building cannot be positively tested as this study cannot draw on any evaluation of the impact of civil society or governance programs in post-conflict Bougainville which would reveal the extent and nature of regional differences. Further, any link between a rise in household income levels and peace-building would not rely on cocoa income alone. Referring back to Table 24, there are differences between the regions in terms of alternative income sources available. Buka has a low income from cocoa, but has alternatives of copra income and employment in Buka town. It is likely that an income study would find that there are only two very poor regions in Bougainville - the south and the western coast - both of which Table 24 indicates have poor alternative sources of income. Buka and the northeast are likely to be found to have a satisfactory level of income. Correspondingly, both these regions have restored peace.

However, if income were the sole determinant of peace - a proposition that the model does not predict - then not only the south but also Torokina would have not restored peace. Torokina is peaceful. As the model predicts, all that can be said is that household income appears to be a variable in peace building, but it is not determinant. In other words ***growth in household income appears to be necessary but it is not a sufficient condition and economic impact is interdependent with civil society and governance factors***. Study of the impact of civil society and governance programs in Bougainville may determine the significance of these other contributing factors.

#### *Concepts of economic growth are culturally relative in Melanesia*

On a cautionary note, the theory tested in this study makes a significant cultural assumption, which is that peace-building is related to economic recovery within a capitalist system. That is, we assume that the local economy can only be improved



by linkage to the international economy. From a Melanesian perspective, this is open to challenge and many in Bougainville question its implications.<sup>92</sup> ***An increase in household income in terms of traditional economy may be an equally effective means to building wellbeing and social cohesion.*** This is a viewpoint that must not be lost sight of in Australia's cultural relations with Bougainville.

### **3.5.2 Appropriateness of RWA assistance**

This section summarises RWA impacts on alleviation of poverty and gender constraints, HIV/AIDS and the environment.

#### *Alleviation of gender and poverty constraints*

Individual projects under BCCDRP addressed gender and poverty by targeting women and disadvantaged groups in cocoa dryer and RDTF distribution. Community work agreements under the roads projects also opened work opportunities to women and disadvantaged groups. However, most effects have occurred through the recovery of cocoa in the rural areas and the access and mobility afforded by the trunk road. While significant, these impacts have been geographically uneven, favouring the northeast. In the south they are imperceptible. Further details of gender and poverty impact are contained in Section 3.2.7 and 3.4.6.

#### *HIV/AIDS*

This study investigated the impact of the road on HIV/AIDS transmission among Bougainville women's and health stakeholders. There appears to be no discernible link between the two in Bougainville, although many are aware that in mainland PNG roads are major transmitters of HIV/AIDS through road labour camps in poor rural areas where prostitution is attracted to road income. Overnight truck stops on long-haul highways, also attracts prostitution in poor rural areas. By contrast, in Bougainville, road labour is sourced locally. Road camps are small and many road workers return home each evening. The truck routes in Bougainville are all traversed in one day and there are no overnight highway truck-stops. Informants appeared to be more concerned about the access that the road affords young people to visit alcohol-vending nightclubs in Buka and in certain roadside locations in the northeast region. It is presumed by many that unprotected sex is the outcome of such excursions. Overall however, the trunk road in Bougainville has not been implicated in spreading HIV/AIDS.

There is also no evidence that BWRP assistance to wharves infrastructure has increased HIV/AIDS transmission. Similarly, no discernible impact from BCCDRP was identified for transmission of HIV/AIDS.

There appear to have been no impacts on HIV/AIDS transmission through RWA assistance, or the rehabilitation of Bougainville's market supply chain.

#### *Environment*

The present study was limited to reporting concerns of environmental damage and to direct observation of environmental damage in its travel through Bougainville. Apart from possible issues with downstream sedimentation at wet crossings there were no outstanding issues of environmental degradation through the BCCTRRP and BCCTRMP road projects. Potential risks from BWRP wharf rehabilitation include damage to sensitive wharf-side marine habitats and disruption of near-shore currents leading to turbidity or shifts in natural erosion and sedimentation cycles. However no

environmental concerns relating to the wharves were raised during the assessment and no negative environmental impacts observed.

For the BCCDRP agriculture and micro-enterprise projects, potential environmental impacts appear to be limited to the harvesting of firewood for crop drying. Overall, this impact has been low. Section 3.4.5, discusses the measures by the BCCDRP to offset firewood harvesting for crop dryer with a tree replacement scheme. The scheme failed to see significant numbers of trees grown to maturity. Firewood harvested was mostly secondary growth softwood from areas already disturbed by human settlement, not from hardwood forests or pristine environments. These softwoods regenerate rapidly and effectively replace firewood harvested. Risks posed by expansion of cocoa growing itself could lead to 1) clearing of pristine environments creating biodiversity impacts, 2) encroach into riparian (stream-side) environments creating turbidity-related impacts, and 3) sheet runoff from clearing could damage agricultural land and cause flash-flooding. No such impact was directly observed or reported by the study respondents.

### **3.5.3 Summary of points arising from social impact evaluation**

For the most part the RWA projects were appropriate in the Bougainville post-conflict situation. The following is noteworthy:

- Good complementarity. In the multilateral context, Australia's activities complemented those of the other donors and both national and sub-national government priorities.
- Emphasis on rehabilitation of cocoa and to some extent copra. Importantly this mirrored the pre-crisis stature of these crops as Bougainville's major agricultural exports: the foundations of these industries were in place.
- Choosing to focus on smallholders in crop rehabilitation. Smallholding is culturally integral with the subsistence economy that Bougainville people had been relying on particularly in the crisis period. Plantations on the other hand would have been almost impossible to re-establish, indeed the problems associated with their start-up prevent their reopening to this day.
- Rehabilitation of cocoa crop processing occurred at an appropriate point in the peace-building process, providing a vital link in the cocoa export chain.
- Road alignment used the existing roadway. The road, necessary as it may be, might have been exceedingly difficult to establish had the roadway and its function as the transport artery not already existed pre-crisis.
- Road rehabilitation occurred at an appropriate point in the peace process to allow traffic for export crops, civil society and governance activities. Spread of lawlessness along the rehabilitated road prior to consolidation of law and order does not appear to have been significant.
- Building equity in the road. Involving the skills base Bougainville had from its mining days in building a road contracting industry, and implementing the community roadwork agreements. These decisions built widespread equity into the road rehabilitation, insuring that it remained remarkably free from landowner-based road closures and rent-seeking.

However, there were two notable faults in the implementation of the RWA. First, there was no explicit performance-linked strategy for SMC, a matter that is discussed elsewhere in this report. Most significantly, it caused failure of the BWRP to meet export shipping needs. A lack of strategic clarity also affected the design of the RDTF to stimulate downstream local business.

Second, evidence of a lack of familiarity with Bougainville and Melanesia is evident throughout the RWA implementation. In particular, social organisational responses to the details of the intervention were not considered. This unfortunately feeds into a common stereotype as one young man in Buka put it ‘Australians come in here, they don’t understand us, they don’t listen and they always think they know best’.

This lack of familiarity with Bougainville culture is particularly evident in some aspects of the BCCDRP, where a multiplicity of implementation issues had a cultural dimension. There was always a good chance that BCCDRP would not handle all of these equally well:

- Mini dryer distribution did not provide enough capacity in high-yield areas. The relatively small number of one-size-fits-all mini-dryers distributed among a very large number of farmers led to overcapacity use. Mini dryers are suited to moderate production on a small plot; they are ‘household size’. Dryers were overloaded when they were shared with extended family across a number of households. More dryer capacity, either more mini dryers or a mix including ‘midi’ dryers was needed in high-yield areas.<sup>93</sup>
- Gender policy was generic in design, not culturally informed. Filling a quota for distribution of dryers to women worked in many cases, but there is no evidence that this was a tailored response to matrilineal social organisation.
- Dryers were released without prior registration, the outcome of which was accurately predicted by the Cocoa Board. Ensuing non-compliance has created problems for the regulator.
- BCCDRP distribution of tree seedlings to cocoa dryer owners was not in keeping with the way farmers work. The National Forest Service offered the advice that in Melanesia forestry plantation is a separate smallholder vocation with its own skills, choices and labour routines. BCCDRP rejected this and the scheme failed almost totally as a consequence.<sup>94</sup>
- Vanilla projects did not adequately train growers about how to produce high grade cured bean; now that the world boom in lower grade vanilla is over, growers cannot sell their crop.
- Trust fund livestock projects had inadequate logistics resources for how the animals would be delivered (in the case of day-old chicks) or fed (commercial pellets for chicks, root crops for penned pigs). Most of these projects failed commercially although many were absorbed into household subsistence.

In some RWA projects, decisions were made in good faith from assumptions that proved to be false.

- The decision to site what turned out to be an overly elaborate wharf project works at Kangu and Panakei in the south was based on the assumption that cocoa yields in the south would match pre-crisis yields after rehabilitation. Yields turned out to be far less.
- Low cocoa yields in the south also affected outcomes for BCCDRP projects in the south.
- The need for a firewood tree seedlings project was redundant. False initial assumptions of the need to burn forest timber in dryers rather than garden regrowth would have been confirmed by field trials. While there may not have been time for these, ongoing discussions with the NFS should have encouraged changes to the implementation strategy in the light of the lessons learnt.

It must be stressed that the RWA assistance was in overall terms an outstanding success. It:

- stimulated the economic growth it set out to achieve
- was an essential element in peace-building
- was value for money
- satisfied the criteria of Australia's development policies with regard to peace-building, gender, poverty and environment.

However, a multilateral effort such as this should have been strategically integrated and based on a deep and accurate understanding of the culture of Bougainville.

### 3.5.4 Cost effectiveness of RWA assistance

A final key question raised in the introduction to this study asked: "Were there ways that the RWA projects in Bougainville could have been delivered more cost effectively"? The following section assesses the RWA projects in terms of fund allocation and value for money.

BCTRRP and BCTRMP were funded appropriately with both complementing the objective of smallholder market chain supply rehabilitation. Based on the results, it could be argued that the money spent in the south was wasted as economic recovery has not occurred as expected. However the road helped rehabilitate civil society and governance across the island, post-conflict, which itself was a necessary condition for economic recovery.

It is generally agreed that under the objectives of the BWRP, of the \$14M spent, perhaps \$5M would have been sufficient for some upgrade to Buka port, a landing craft ramp at Kangu and a far less elaborate goods sheds at Kangu and Panakei. This would have been sufficient even if agricultural production in the south had climbed to expected levels. If EU's commitments had been transferred to AAB, extra funds would have been spent on facilities at Kokopau (perhaps \$2M), Wakunai and Torokina (perhaps \$1M each). Consideration could still be given to a vehicle barge across Buka Passage, which is needed if Buka wharf is to be better used for export.

On the other hand, BCCDRP was under-funded. More dryers were needed overall to meet the capacity required to process the yields from existing tree stock and anticipated increases in yield from BCCRP cocoa. Although BCCDRP was only expected to kick-start the industry, it did so with a shoestring budget, with consequent problems of overcapacity use of dryers and quality concerns for the regulator. Further, no provision

**Table 26. Alternative funding scenario for RWA assistance**

ACTIVITY	EXPENDITURE (\$M)	ALTERNATIVE (\$M)
BCTRRP	13.2	13.2
BCTRMP	24.2	24.2
BWRP original objectives	14.0	5.0
BWRP cocoa wharves	0	4.0
BCCDRP	7.7	9.0
Feeder roads	0	3.5
Strategic detailed planning	0	0.2
<b>TOTAL</b>	<b>59.1</b>	<b>59.1</b>

was made for a trust fund that would enable dryer refurbishment, an emerging issue that requires quick redress.

The BCCDRP rural development trust fund was to some extent mis-targeted and premature. In essence it promoted income generation from micro-enterprise consisting of local business supported by customers who had money from sale of cocoa. It did this with a sole focus on individual projects, through the trust fund. Much of the budget was wasted on commercially non-viable livestock projects. Many other businesses provided 'luxury' goods such as bread (a luxury in rural Melanesia) even when districts such as in the west coast had little income from cocoa to be able to afford such things. Thus, the trust fund was premature in districts where not all the links in the cocoa market supply chain were established.

Despite this, a local economy of marketed fresh produce has built up, especially among women, selling root crops, greens, fruits and cassava pudding at prices affordable even in the poorest districts. This was independent of the trust fund. EU provided steel-roof market pavilions in Buin, Arawa, Buka and Kokopau with great success in stimulating market activity. Such pavilions remain an option for local market stimulation in Tinputz, Wakunai, Siwai, Bana, Kunua and Torokina. Particularly because of the shortfall in dryer capacity delivered, BCCDRP is estimated to have been under-funded by at least \$1M.

Feeder roads were not addressed by RWA as part of the SMC rehabilitation. There are clusters of cocoa communities inland of Wakunai and Tinputz which are underperforming as cocoa producers due to a lack of feeder roads. The matter should be investigated with a view to improving market/service access, governance and regional integration. While caution should be exercised in considering funding for feeder roads, significant inroads can be made with an investment of around \$3M.

In retrospect, RWA funding may have been better allocated as in Table 26. These alternative estimates may be considered in the light of future assistance priorities.

# 4 Cost-benefit analysis

THE COST BENEFIT ANALYSIS ESTIMATES the costs and benefits of the roads, wharves and agriculture (RWA) projects. Little data was collected in Bougainville during the crisis and such data as is collected now, is often ‘rough and ready’. In the absence of an opportunity for fine-grained analysis, the cost benefit estimates provided here describe the general order of magnitude of changes and indicate how the benefits of the RWA projects weighed against the costs. The data constraints and assumptions applied in this section are detailed in Annex 7.

AusAID’s projects, though not parts of a collective design (see Section 1.2) provided important market chain links between agricultural producers and their export markets. Most of the projects increased rural incomes and employment, and through better transport services also contributed to increased mobility, better access to services (schools and clinics), community peace building and reconciliation activities and have assisted in maintaining law and order. Other benefits have included significant local investment in public transport and road construction plant. Those benefits that have arisen from the dynamics of the market chain as a whole will be referred to as cumulative benefits, whereas benefits arising from a single sector (e.g. investment in road construction plant) will be referred to as stand-alone benefits.

During the nine years from 1997 to 2006, AusAID spent approximately \$59 million on its RWA projects, amounting to 29 percent of all AusAID spending on Bougainville in that period.<sup>95</sup> A spending breakdown is shown in Table 27. The CBA here provides a conservative estimate of financial benefits that can be attributed to this spending. To do this, it compares the situation resulting from the RWA projects with a ‘base case’ or ‘counterfactual’ scenario, i.e., what could have been expected in the absence of this intervention. Data constraints and methodological issues meant that many benefits could not be quantified in dollar terms, and those that can are often approximate.

## 4.1 Cumulative benefits

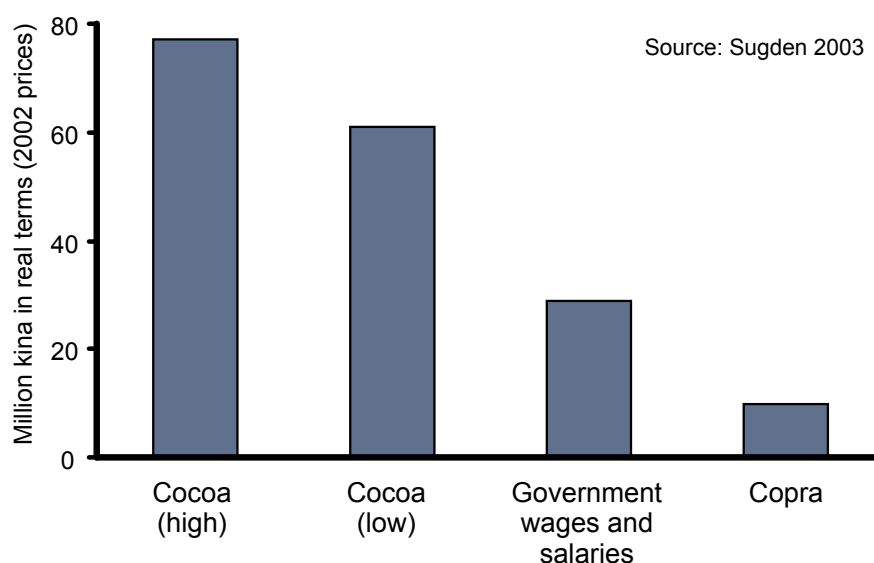
This CBA concentrates on those benefits that have a dollar value. Other benefits such as those mentioned above have been covered in the preceding social impact evaluation. Most financial benefit of the RWA projects has been through market chain rehabilitation which has directly facilitated the recovery of agricultural exports, chiefly cocoa. Investment in public transport and road construction plant has been an important secondary financial benefit.

Cocoa production was already on the rise in the two or three years between restoration of shipping in 1997 and the inception of RWA projects in 2000 (Section 3.1.3). Cocoa

**Table 27. Expenditure on project activities included in CBA (current \$)**

	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	Total
BTRRP	36,711	212,567	3,268,490	5,000,179	4,717,208	-	-	-	-	13,235,155
BTRMP	-	-	-	1,959,992	6,246,357	6,301,572	3,721,748	6,000,000	-	24,229,669
BWRP	8,194	27,685	64,677	92,562	1,433,519	5,471,027	6,133,746	500,000	250,000	13,981,410
BCCDRP	-	-	23,421	376,650	1,511,143	1,962,743	1,236,295	1,356,397	1,210,417	7,677,066
<b>Total</b>	<b>44,905</b>	<b>240,252</b>	<b>3,356,588</b>	<b>7,429,383</b>	<b>13,908,227</b>	<b>13,735,342</b>	<b>11,091,789</b>	<b>7,856,397</b>	<b>1,460,417</b>	<b>59,123,300</b>





**Figure 34. The main sources of spending over the long run**

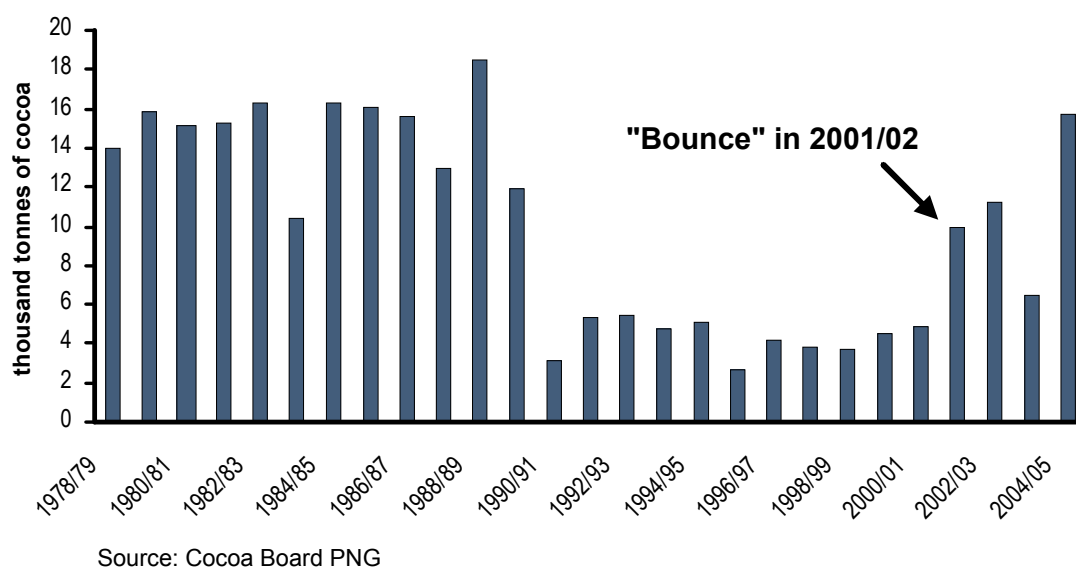
production has risen rapidly since, in part because rehabilitation of smallholder cocoa was carried out by the UNDP's concurrent BCCRP cocoa seeds and seedlings project beginning in 1998 and partly because farmers were attracted to cocoa with the rapid increase in its price after 2000. Cocoa now provides about 90 percent of Bougainville's export crop income (Section 3.1.2). As a result of its significance as a cash earner, the estimate of RWA financial benefits will focus on cocoa.

Bougainville's secondary export crop, copra, currently returns the other 10 percent of overall agricultural revenue to Bougainville. Copra production fell at the beginning of the conflict and after some recovery associated with establishment of peace in the northern areas of Bougainville in the mid-1990s has not experienced growth (Figure 13). Copra growth since inception of the RWA most likely stalled because smallholders have shifted where possible to the more lucrative cocoa crop. While RWA has undoubtedly benefited copra producers, stagnation of this crop since the RWA projects indicate little cumulative benefit from RWA for the copra market chain. In consequence copra is not further considered in this CBA. Other crops such as vanilla and horticultural produce have no export market at present and are also not further considered.

The benefit to cocoa production attributable to the RWA projects is treated as the primary cumulative benefit. Estimates of benefits to transport and road plant investment are considered as stand-alone benefits.

#### **4.1.1 The value of rehabilitating the cocoa sector**

Cocoa is the main cash crop in Bougainville and the predominant income earner (see Figure 34).<sup>96</sup> The most significant benefit of aid was an increase in revenue for Bougainville through cocoa exports. While cocoa exports accelerated in response to aid, there were other parallel forces at work. UNDP observers noted rapid increase in cocoa production beginning as early as 1997 when shipping was re-established in northern and parts of central Bougainville, although this was not statistically recorded (Section 3.1.3). This increase occurred without aid, beginning almost three years prior to the establishment of the RWA projects. A tree stock survey carried out just after the crisis ended, estimated that at that time a pre-crisis legacy tree stock of just under nine million



**Figure 35. Cocoa production in Bougainville, showing ‘bounce’**

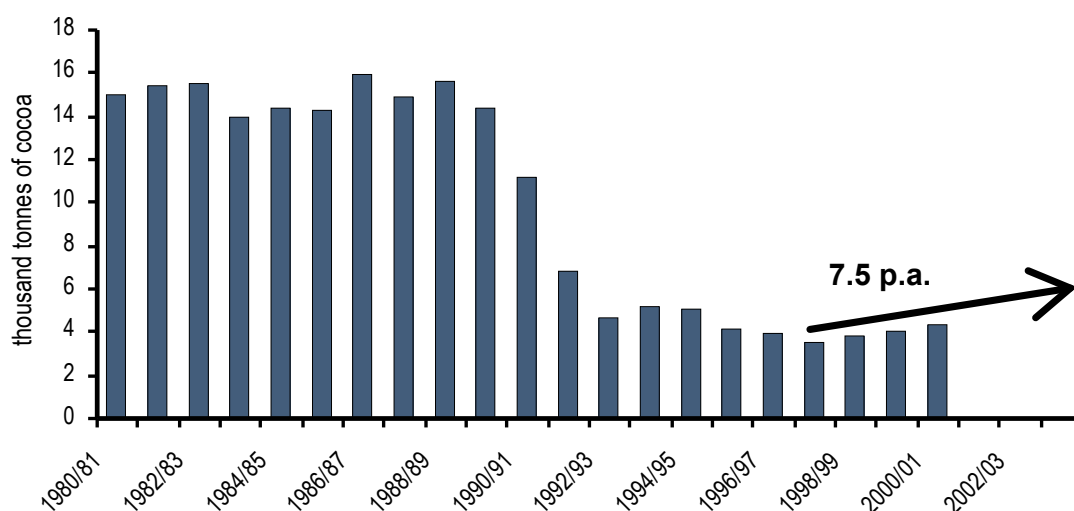
trees were bearing pods, another two million young trees were maturing and a five million drought-affected trees were capable of restoration.<sup>97</sup> Figure 36 which shows the ‘counterfactual’ or ‘base case’ therefore makes an allowance for growth in output.

Based on the 3-year moving averages indicated in Figure 36, there were clear signs that cocoa production in Bougainville was recovering in the second half of the 1990s i.e., *before* the AusAID projects were implemented. The last four moving averages up until 2000/01 all increased, with the average increase at 7.5 percent per year. This suggests that cocoa production would have improved with the consolidation of peace even without aid. Figure 35 then indicates a ‘bounce’ in production during the 2001/02 marketing year, about the same time that major road works under BCTRRP were completed (BCCDRP was also well under way). Importantly this bounce was assisted by rising prices, which encouraged smallholders to increase production, i.e., to harvest pods from legacy tree stock that might not have been harvested otherwise.<sup>98</sup> The world price of cocoa doubled over 2001 and 2002. In conjunction with continued depreciation of the kina, this translated to a delivered-in-store price of K3,000 per tonne in 2001 to an average of K6,200 per tonne in 2002.<sup>99</sup>

Given the productivity of existing tree stock, signs of recovery prior to aid intervention and production bounce due to price response, Bougainville’s cocoa income stream can only partially be attributed to the RWA projects. Below, the case will be made that the real effect of the RWA projects was to accelerate recovery in Bougainville to pre-conflict levels much sooner than otherwise. Without the BCTRRP and BCTRMP the main road would have remained largely impassable, and without the BCCDRP, the capacity to dry cocoa would have been severely constrained and even simple cocoa tools would have been in short supply. To establish this, the counterfactual of what would have happened if there were no RWA projects is examined.

#### 4.1.2 What if no aid had occurred

Bougainville cocoa production returned to pre-crisis levels around 2004/05, rising above 15,000 tonnes/annum for the first time since the start of the crisis. A question of interest is how long it would have taken for production to rise to that level without aid.



**Figure 36. Three-year moving averages**

To estimate this counterfactual case, the conflict era average annual production of 4,225 tonnes is taken as its base and projected into the future using an annual growth rate of 7.5 percent. This rate is based on the evidence of the 3-year moving averages indicated in Figure 36.<sup>100</sup> Figure 37 presents the result which forecasts that if no aid had been applied, production would have returned to pre-conflict levels around 2017, twelve years later than has actually happened.

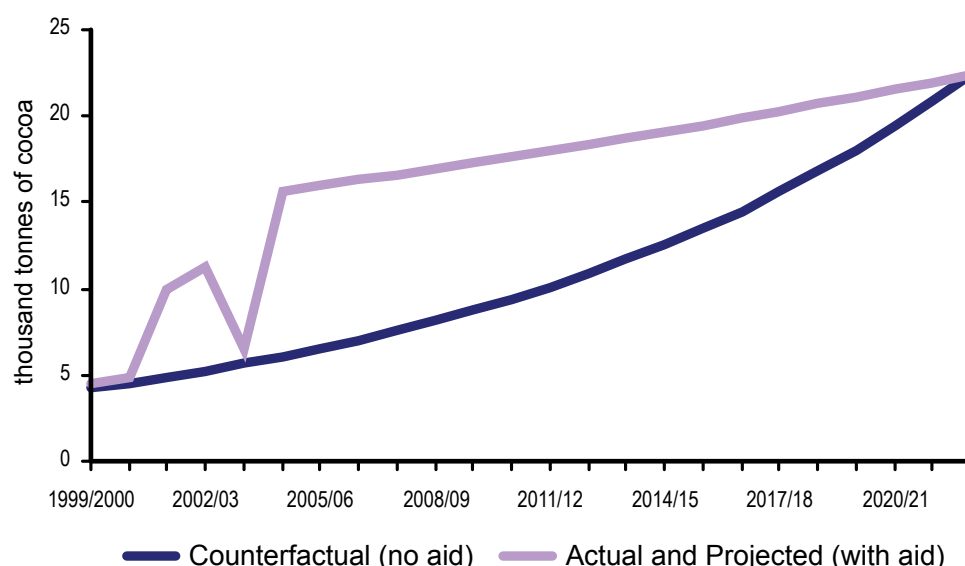
This ‘bringing forward’ of cocoa exports is the *key* benefit of AusAID’s projects. It dwarfs all other economic benefits from the projects and may be evaluated in two ways:

- An assessment of the volume of exports brought forward (i.e., how much?); and
- The value of this export (i.e., what price?)

In relation to the size or volume of the exports gained, the situation ‘with aid’ is compared with the counterfactual or base case. The ‘with aid’ series shown in Figure 37 follows actual production figures until 2004/05 and projects further growth at a ‘conservative’ rate of 3 percent per annum over the next 15 years on average, to reach a total of around 22,000 tonnes per annum by 2022. This is a conservative estimate for the following reasons:

- In line with the above, Sugden (2003) also concludes that “20,000 to 25,000 tonnes per annum over the long term” would be reasonable. In contrast, an assessment for the BCCDRP forecast that output levels would reach 21,000 to 27,000 tonnes by 2010 – well in advance of anything suggested in this CBA<sup>101</sup>
- Cocoa output is set to grow, with the high-yielding UNDP seedlings reaching full potential over the next few years and additional areas will continue to come under cultivation
- The recovery has been achieved almost exclusively through increased smallholder production, whilst formerly the plantations sector was predominant. Restoration of the plantations would increase production
- Global demand continues to be strong *and* Bougainville produces premium quality cocoa beans. Bougainville is a very small global player and there is scope for the market to absorb additional cocoa from Bougainville

Figure 37 shows that the counterfactual and with-aid series converge in 2022 because the costs do not include recurrent cost financing (RCF), i.e., the costs of maintaining the infrastructure over time. Without RCF early gains through AusAID support will



**Figure 37. Bougainville cocoa production with and without aid projects**

dissipate. With RCF in the analysis, the wedge between the ‘with-aid’ and ‘without-aid’ series will be permanent and the series will not converge.<sup>102</sup> Projections are not made beyond a project horizon of 2022. RCF options are discussed at the end of this chapter.

### 4.1.3 Global market trends and cocoa price projections

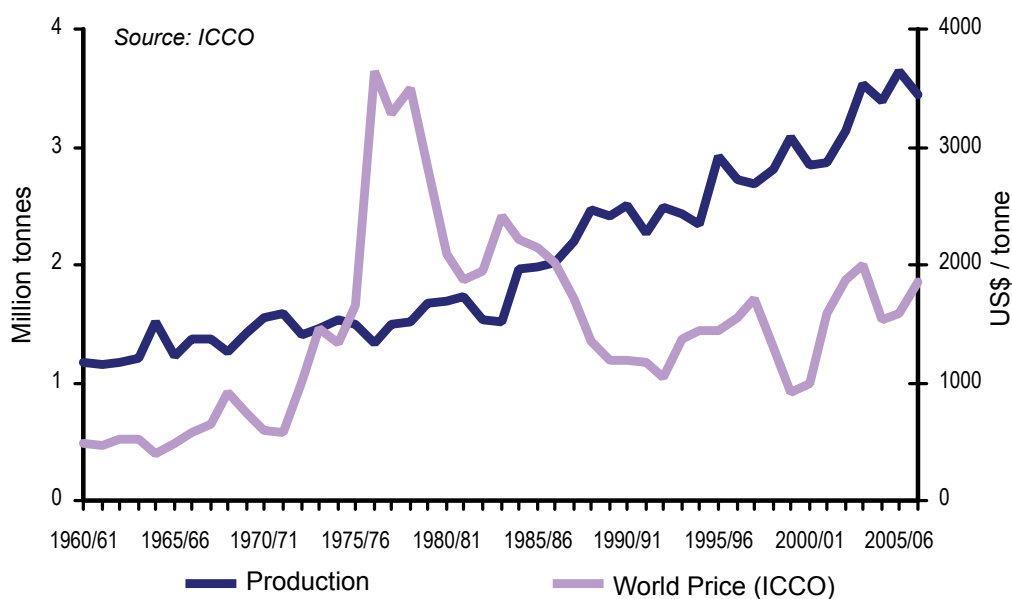
Having determined the time span for attributing the benefits, an appropriate price measure for the stream of generated exports must be set based on the global market and the world price of cocoa. Figure 38, which plots the global production of cocoa against the world price shows that production of cocoa has increased nearly fourfold over the last half century – from around 1 million tonnes in 1960 to nearly 4 million tonnes more recently.<sup>103</sup>

World prices have also nearly quadrupled from around \$500 per tonne in the early 1960s to just under \$2,000 per tonne in the late 1990s (ignoring the inflationary period of the mid-1970s). Monthly average prices climbed to nearly \$2,200 during several months in the 2002/03 marketing year. The market is currently ‘tight’ and the daily ICCO world price stands at around \$1,976 with a prognosis of rising prices over the remainder of this marketing year.

In real (i.e., inflation-adjusted) terms, world prices of almost all commodities have fallen during the last half century to which cocoa is no exception. Figure 39 reveals that on average, the real inflation-adjusted price of cocoa has fallen at a rate of 2.3 percent per year since 1960/61.

It is arguable that the mid-1970s with the oil shocks were an aberration that ‘skewed’ this result and that such inflationary periods are unlikely in the twenty year period of this CBA. However, even if the real price of cocoa is capped at \$4,500 for the mid-1970s, there is still an average annual decline of 2.1 percent per annum.

Note however, that real (i.e., inflation-adjusted) cocoa prices have actually risen during the last decade at an annual rate of approximately 6.6 percent. Agmark Pacific confirmed that PNG cocoa has appreciated vis-à-vis terminal markets during the last decade.<sup>104</sup> This



**Figure 38. Global production of cocoa and world prices**

is illustrated by the fact that at least some Bougainville plantation cocoa was being sold at a premium of UK£70/tonne to international chocolate makers prior to the conflict.<sup>105</sup>

In projecting Bougainville cocoa prices over the next two decades, at least three possibilities can be envisaged:

- An *optimistic view* that premium quality will continue to attract good prices vis-à-vis the terminal markets especially if the current structural tightness in the global cocoa market persists
- A *pessimistic view* based on the longer term trends alluded to earlier
- A *neutral view* that works on the assumption of flat real prices

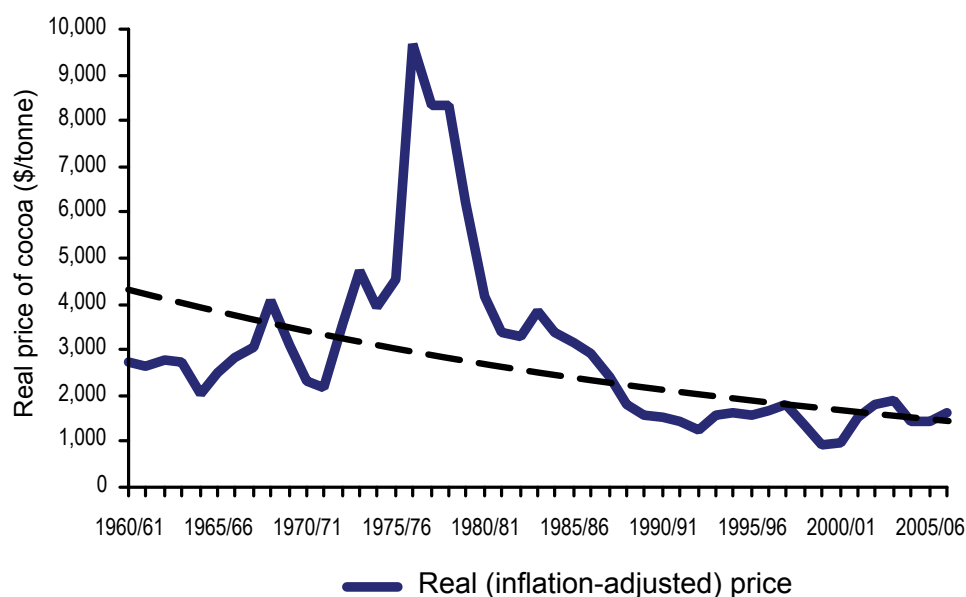
This CBA takes the neutral view.

#### 4.1.4 Estimate of cumulative benefits

To measure the economic benefits to Bougainville from the projects an estimate of the local 'value added' associated with the increased exports of cocoa and other agricultural products is required. This means that the costs of local and imported inputs (excluding labour) and some government taxes should be subtracted from any additional export earnings that flow from the projects. These potential cost categories are discussed in the following sections.

##### *Fuel and other input costs*

Data from one of the major fuel retailers shows that annual sales of fuel in Bougainville have risen by around 50 percent since 2003 (see Figure 40). Consistent growth in sales, including over the period in 2003/04 when cocoa output and exports fell, suggests that travel other than for transporting cocoa formed a significant proportion of travel in Bougainville. Otherwise, fuel sales would have fallen dramatically during the low cocoa export years. Road traffic counts in Bougainville found that only a small proportion of vehicular traffic consisted of goods trucks. Landcruiser-type vehicles including PMVs accounted for much of the road use.



**Figure 39. The real (inflation-adjusted) price of cocoa**

Without any clear evidence on input use, it is difficult to establish measures of changes in fuel, freighting fees, costs of operating the new cocoa dryers and other input costs resulting from AusAID's intervention. Cost increases due to the AusAID projects were limited by the following factors:

- Smallholder production in Bougainville is labour-intensive with limited use of purchased inputs (seedlings were, for example, provided free of charge). However extra labour due to increased production (e.g. local youth to help maintain the trees and cutting dryer firewood) is purchased at low wages
- In remote areas, surplus labour is used to transport produce, especially where there is a lack of feeder roads
- Ships, barges and trucks used for transport can often take additional volumes of produce, i.e., at only a marginal increase in costs. Thus, economies of scale can reduce per unit costs
- Significant increases in production costs, such as tree-maintenance labour costs noted above, are attributable to the increase in cultivated area and increased yields resulting from the UNDP BCCRP seed and seedlings project, not to the AusAID RWA projects

To avoid overestimating benefits, allowances are made for the possibility of increased fuel costs to transport the crop to the ports, as well as potential intermediate costs incurred by smallholders such as wages for labour. \$50 per tonne of additional cocoa exported over and above the baseline or counterfactual scenario is estimated to account for any increases in fuel and other input costs caused by AusAID's interventions.

#### *Government taxes, charges or levies*

An increase in production and exports can lead to an increase in demand for specific government services. Where governments raise tax or use other charges to cover the cost of these services, these must be deducted from any benefits estimate based on increased export earnings.<sup>106</sup>



In Bougainville, the Cocoa Board imposes a ‘management levy’ on cocoa exports that should be deducted from the calculation of benefits. The charge currently stands at 40 kina per tonne (approximately \$17 per tonne of cocoa).

The cocoa ‘stabilisation levy’ which has now been phased out but which existed during the early part of the project has not been factored in, as its effect cannot be determined.<sup>107</sup>

#### *Farmer co-contributions for cocoa dryers*

The cocoa mini-dryers under the BCCDRP project were significant in making additional dry cocoa available for export. Although the dryers were part-purchased by the farmers, their cost has not been deducted from the benefits estimate because the equity paid by farmers was directed into the RDTF used for small rural development enterprises.<sup>108</sup> In other words, this impost on farmers has been returned directly to the community and therefore does not present a cost that should be ‘netted out’ of the benefit measure.

#### *Cumulative benefits from increased cocoa output – results*

Likely additional volumes of cocoa produced over a project horizon up to and including 2022 have been estimated above. This additional production has been valued using the ‘neutral’ price projection, and then the necessary deductions as discussed immediately above were made. On this basis, it is estimated that the Bougainville economy will benefit from additional cocoa revenues of K586 million (\$249 million) over and above what would have occurred in the absence of any foreign aid projects. After discounting at 6 percent p.a. to the baseline year (2000), this equates to a ‘present value’ of K309 million (\$133 million).<sup>109</sup>

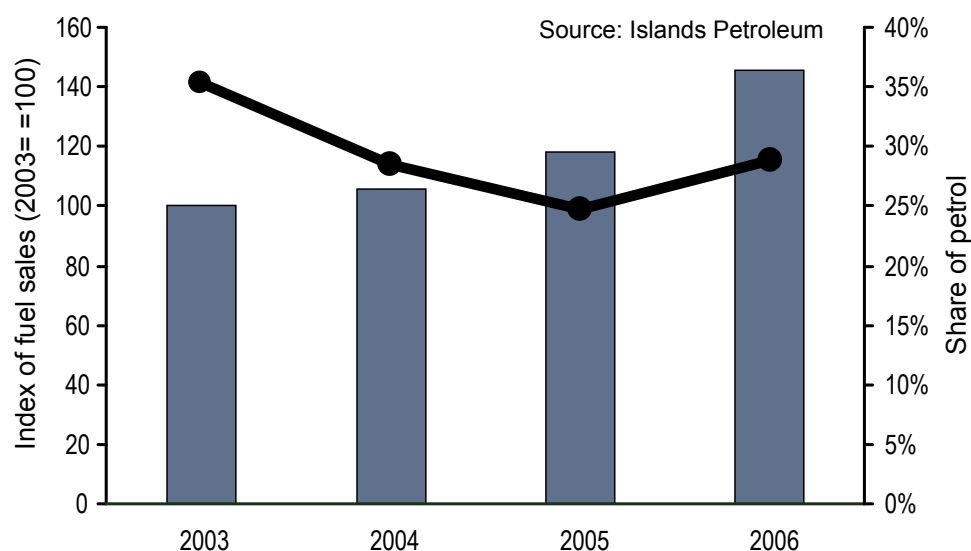
However, before comparing these benefits with the costs incurred by AusAID, the proportion of benefits that can be plausibly attributed to the project activities must be determined.

#### *Cumulative benefits attributable to AusAID*

How much of the ‘observed’ benefits (including future benefits) should be attributed to AusAID depends on the view taken on the contribution made by the RWA projects. A number of factors have contributed to increased cocoa production in Bougainville, as has been discussed above. These include attainment of peace, existing cocoa capacity and the rise in cocoa prices. In terms of financial inputs, aid was delivered by a number of donors both directly affecting cocoa production, and indirectly by aiding the peace process in other ways. Private individuals and community organisations also provided financial and other support independent of donor funds.

One method for solving the attribution issue is to ask how much of the total aid effort came from AusAID, and how much of this was relevant to increasing cocoa production and exports. Summary figures from the 2002 and 2006 ABG budgets suggest that AusAID has accounted for 60 to 80 percent of major donor funding in Bougainville in recent years. This would plausibly represent the ‘upper limit’ of the attribution that could be made for AusAID. Next, it must be considered that whilst AusAID’s RWA projects were most closely and directly associated with increasing agricultural production and exports from Bougainville and Buka, they represented only one third of the Agency’s spending in Bougainville during the study period (Figure 2).

On balance, it would appear reasonable to suggest that around half of the increased cocoa revenues may be attributed to AusAID’s RWA projects. An attribution factor of 50 percent yields an estimate of \$66 million worth of cocoa benefits that can be attributed



**Figure 40. Index of fuel sales into Bougainville (2003 = 100)**

to the RWA projects (half of \$133 million). These figures can now be compared to the \$47 million discounted cost incurred by AusAID. Significantly, the ‘attributable’ benefits from increased cocoa production therefore outweigh the costs covered by this CBA under all but the most conservative assumptions.

## 4.2 Stand-alone benefits

This section first considers financial benefits that have been generated beyond the export revenue from cocoa. Finally it considers the question of attributing benefits from each of the RWA projects as separate components to cocoa export revenue.

### 4.2.1 Trunk road rehabilitation and maintenance

During the crisis, the roads deteriorated through lack of maintenance. Cocoa was only exported from north Bougainville. The PNGDF blockade had obstructed cocoa exports from central and south Bougainville. Copra exports, from Buka Island, were also constrained by unmaintained roads.

The BCTRRP and BCTRMP trunk road rehabilitated the Buka east coast and ring roads, most of the main trunk road from Kokopau south to Jaba River and the access road to Kangu jetty. Bridges, feeder roads, some sealed road sections along these routes were generally not included. Sections 2.1, 2.2 and 3.2 provide more detail on the BCTRRP and BCTRMP.

Some additional benefits of the roads above and beyond their contribution to cocoa export revenue are estimated below. However an absence of data prevents rigorous statements about benefits such as reductions in passenger travel costs and/or transportation costs; travel time reductions (and the value of time saved); improvements in the comfort of travel (and the value thereof); lower numbers or rates of accidents, injuries and fatalities (along with a valuation of this set of benefits); employment creation during project implementation and consequent monies retained on the island (economic ‘multipliers’) and the value of the creation of a small competitive sector of service contractors (e.g., metal fabrication, road maintenance, etc).

### *Increased personal traffic and travel time reductions*

Traffic along the trunk road has not only increased due to cocoa freighting. Personal traffic has also increased. This comprises travel undertaken for family, community and social activities, commuting, travel to access town-based services and commerce, local produce marketing, and government service delivery such as policing.

This is indicated firstly by fuel sales data from 2002 to 2006 (Figure 40) which indicates that annual diesel and petrol sales on Buka and Bougainville have risen by around 50 percent since 2003. Sales steadily increased even over the period in 2003/04 when cocoa output and exports fell. This indicates that travel other than for transporting cocoa formed a large part of the travel. Otherwise, fuel sales would have fallen during the low cocoa export years. Second, the number of passengers using PMVs has approximately doubled since the end of the crisis (although overall traffic density is still relatively low).<sup>110</sup>

Concurrently with the doubling in traffic, road rehabilitation has also reduced travel times (see Table 28). The before and after Kokopau–Arawa time is as follows: 12 hours before the upgrade, 3+ hours now, A representative travel time saving of two hours across all journeys is presented in Table 28. Taking Chand's (2004) estimate of per capita income in PNG in 2000-04 as \$923, travel time saving is calculated at \$0.32 per hour.

Traffic counts (Section 3.2.1) indicate a daily average of 360 vehicles used the coastal trunk road. Most were "buses" and PMVs, with between 10 and 30 passengers. Assuming that traffic volumes doubled following project implementation, around half of the traffic volumes benefited from shorter travel times. Approximately 180 journeys per day with travel time savings of two hours per passenger yields savings of 3,600 hours per day. Assuming the life span of the road at ten years without maintenance and discounting the benefits by 6 percent per annum, the net present value of these benefits is \$3.1 million at a value of \$0.32 per hour; discounting by 9 percent reduces this to \$2.6 million.

### *Generated traffic, vehicle operating costs and consumer surplus*

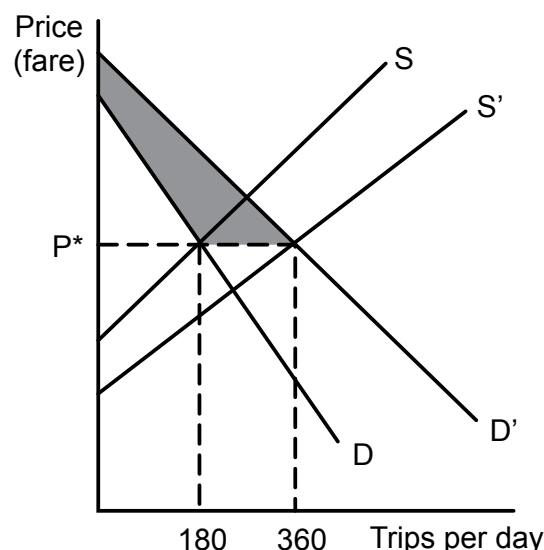
Noted above was the doubling of PMV traffic. Consequently, where there was one PMV operator previously running a service from Kokopau to Arawa, at least a dozen competitors have now entered this market. Despite this, the one-way fare from Arawa to Kokopau has remained at K50 (\$21 at the current exchange rate) which is still high relative to local incomes.

Respondents said that road rehabilitation had not reduced vehicle operating costs which partly explains why long distance fares have not declined. Further, Section 3.2.1

**Table 28. Travel times in Bougainville**

From	To	Distance (km)	Pre restoration	Post restoration
Arawa	Wakunai	72	>2hrs	1hr 10mins
	Tinputz	128	3.5hrs	2hrs
	Kokopau	183	>7hrs	3hrs
	Buin	106	>5hrs	2hrs
Buin	Kangu Beach	12	1hr	20mins
	Lalaui River	36	3hrs	1hr 30mins
	Tonu	40	2hrs	45mins
	Sovele	80	>8hrs	1hr 45mins

Source: BCCTRP Project Completion Report May 2002



**Figure 41. Example of a change in ‘consumer surplus’**

demonstrates that freight costs are particularly high where there is no road and that there are regional differences in fares with increased river crossings. Without reliable cost data, a conservative approach was taken to exclude ‘producer surplus’. Figure 41 illustrates the consumer surplus approach to valuing road user benefits; it also presents a possible interpretation of the shifts in supply and demand helped by the roads projects following peace in Bougainville.<sup>111</sup>

There are several other challenges to putting a value on this benefit, notably:

- Determining how much additional traffic has occurred with peace but without road rehabilitation; and
- Identifying a representative average fare for the purposes of calculating the monetary value of the consumer surplus generated.

Other benefits were:

- community participation (including women), especially from roadside and drainage works;
- marketing of produce;
- accelerated peace process with increased participation in economic activity, both direct (e.g. agriculture, transport operation) and indirect (e.g. provision of fuel and tires) and increased mobility
- school attendance.<sup>112</sup>

Accepting that both the roads projects and peace contributed to the increases in travel volumes a 50 percent attribution factor for the roads projects is adopted from the approach to cocoa exports.

Using K5 as a ‘representative’ fare paid on the 180 additional vehicle journeys per day, with on average ten travellers per vehicle and, applying a rule of half-of-half (see Annex 7), the ‘daily’ consumer surplus is equal to 1,800 person journeys multiplied by K1.25. Further, limiting the project at ten years without maintenance, road user benefits in net present value terms, are estimated at \$2.3 million to \$2.7 million.

### *Capacity building and sustainability*

The BCTRRP Completion Report maintains that “active engagement with communities on works across clan and factional boundaries has been highly beneficial ...

Subcontractors have received [on the job, informal] training and assistance in tender preparation and estimating, plant operation, plant maintenance, operations management and scheduling, construction and maintenance procedures and financial management...”

There are several small road construction companies each with small fleets of road-building machinery (Section 3.2.2). The Managing Contractor confirmed that these companies can build and maintain roads. Community groups are also seen undertaking basic road maintenance. The Completion Report further states that ‘the Managing Contractor has provided counterpart agencies [Bougainville government] with a cost and schedule of maintenance activities that are considered essential for maintaining the trunk road at a reliable standard. The schedule identifies maintenance tasks, road inspections and has an allowance for emergency and unforeseen events. The road maintenance capacity on Bougainville now has the resources and capability to maintain the trunk road at or near its current standard. Likewise counterpart agencies understand the benefits of maintenance and have the skills necessary for management of maintenance activities’.

Several Bougainville contractors now have capacities beyond mere road maintenance and can participate fully in competitive tendering that may lead to substantial all-round savings<sup>113</sup>. The BCTRMP Final Completion Report states that: ‘there are now three main principal contracting organisations on Bougainville who employ up to eight small local plant owners to assist with rehabilitation or maintenance contract works. These principal contractors are now computer literate and able to tender for and administer medium sized (\$0.5M to \$1.0M) road maintenance and rehabilitation contracts’.

However, as this local contracting industry relies predominantly on donor funding, the monetary value of this benefit cannot be isolated. It must therefore be considered an added bonus, difficult to evaluate as it involves forecasts of future AusAID spending.

### *Contribution to local value added*

The above benefits can be reflected in cost-benefit analyses through an examination of ‘retained’ spending, i.e., a valuation of that share of project expenditure that does not ‘leak’ out from the Bougainville economy and its contribution to local value added (i.e., GDP). As no input-output models exist for the Bougainville economy at present on which value added multipliers can be based, this study relies instead on two assumptions instead:

- Around 70 percent of the roads project funding went to local contractors,<sup>114</sup> and
- We suggest a 20 percent multiplier, which means that 20 percent of the expenditure reaching the contractors was retained as value added in Bougainville.<sup>115</sup>

The latter assumption is derived from the BCTRRP Final Completion Report which states that ‘community groups have actively participated in the implementation of the project, with approximately 11 percent of the total rehabilitation expenditure of \$6.5M being expended under formal Community Agreements’.

Labour from sources other than community groups, net profits and indirect taxes if any, would have to be added to this 11 percent share to obtain the full value added contribution. The BCTRMP Final Completion Report further states ‘Participation of community groups has exceeded those levels set by the former project and expenditure for community based work programs at project end reached 20% of the overall maintenance budget’.

Since the contribution of the community groups primarily consists of labour – which is part of value added – a value added multiplier of 0.2 is justified, if even conservative. The Completion Report does not provide sufficient financial information for taking further the estimate of the value added contribution of the AusAID projects to Bougainville.

On the assumptions presented above, the estimated net present value of the value added contribution is \$3.9 million at a 9 percent discount rate and, \$4.3 million at a 6 percent discount rate.

#### *Accidents, injuries and fatalities*

No information is currently available to help evaluate this category of benefits/costs. While additional traffic can lead to an increase in accidents, traffic densities are still very low in Bougainville and anecdotal evidence suggests that accidents are rare.

### **4.2.2 Wharves rehabilitation project**

The review of the wharves is based mainly on project design and completion reports, discussions in Bougainville and inspection of the Buka wharf (refer also to Sections 2.3 and 3.3 for detail on BWRP). The overall purpose of BWRP was to enhance agricultural exports, seen to be the most efficient way to re-establish the economy of Bougainville.<sup>116</sup> In brief, BWRP consisted of:

- major extensions centred around construction of a container facility, alongside the existing break-bulk wharf at Buka
- the construction of a jetty, landing barge ramp, and associated storage facilities at Kangu Beach
- construction of a storage shed at Panakei in the Siwai district.

Prior to BWRP, Buka was a local port that had become the centre of shipping activity due to the shift of government and business to Buka during and after the crisis. Kieta was an international port largely fallen into disuse during and after the crisis. The main export income earner, cocoa, is predominantly shipped from Kokopau wharf but this was not part of BWRP.

Section 3.3 assembles available import and export tonnage data for Buka wharf for the full period before and after BWRP. This is measured in revenue tonnes which cannot be costed accurately. However, it is quite clear from the available information that export volumes from the new container wharf at Buka are insignificant relative to total export from Bougainville. The available data for Kangu jetty also reveals insignificant relative value. Quantitative calculation of project benefits over time through tonnage data is avoided here, as it is not precise enough. In qualitative terms, the benefits are:

- improvements in freight handling and reductions in shipment costs, mainly through reductions in spoilage
- an increase in bulk handling efficiency
- the ability for larger ships to dock.

These changes have enabled speedier transshipment of crops (speeding up delivery to bulking points from where crops are taken in larger ships to international markets, or through direct access to international markets), as well as facilitating the export of containerised goods from Buka. However, Section 3.3 of this report establishes that capacity at both Buka and Kangu was over specified.



Local employment during project implementation added value within Bougainville (so-called multiplier effects). Data on the number of short term labourers employed was not available and the added value has not been calculated.

### *Buka wharf*

Buka is Bougainville's main copra export port, although most copra goes break bulk rather than by container. In principle the extended wharf allows increasing volumes to be handled more efficiently than in the past. The proposal to extend the wharf was justified on the basis of serving increasing exports. Section 3.1.1 describes the Buka wharf project in more detail.

Construction at Buka proceeded without considering the context and the alternatives. In short, the practical alternatives at Buka were: increase the existing break-bulk handling capacity, install modest facilities to suit inter-island container vessels, or install large containerisation facilities to suit international vessels. The latter option was chosen, notably with little improvement to existing break-bulk (copra export) capacity. This appears not to have been based on initial cost benefit analysis. For example, the PDD did not estimate delay and demurrage costs. Such costs should have been compared with the capital cost of extending the wharf to determine whether there was a positive cost-benefit result. Only passing reference was made to other options, for instance to improve the poor efficiency of break-bulk loading and unloading without extending the wharf, an option that could have enabled faster turnaround and might have precluded the need to extend the wharf.

Considering the stated purpose for BWRP of enhancing agricultural export, alternatives should have explicitly considered shipping activity. Due to the price and volume of cocoa, it is clear that the majority of potential export value that could be routed through Buka port is from the main cocoa producing districts on mainland, which is across the Buka Passage. Goods were efficiently transported across the passage by barge in pre-crisis times but it was destroyed. The lack of a barge has compromised the very export efficiency that the wharf extension was expected to improve. A new barge would have been better use of aid money, but appears not to have been considered.<sup>117</sup>

In sum, there was no consideration given to whether the money spent on this wharf would have been better spent elsewhere, such as a new Buka Passage vehicle barge, other wharves or even on further roadwork.

### *Kangu jetty and the goods sheds at Kangu and Panakei*

Kangu jetty is visited fortnightly by Agmark and Garamut ships. Garamut's *Boulari* is a deep hulled vessel that must use the jetty. Agmark uses landing craft for which a jetty is useful but not essential. However, even for a landing craft the use of a landing ramp rather than a jetty potentially increases spoilage and labour costs and to this extent, there may have been some improvements in efficiency associated with switching from ramp lading to derrick lading. It is certain that some form of jetty or ramp has improved the situation over the previous method of taking goods out to ships anchored offshore. It is also plausible that Kangu jetty has stimulated some exports because alternative land transport to Kieta is presumably more expensive. On the whole however shipments have proved minimal, with the Kangu jetty underutilised and the sheds at Kangu and Panakei having never been used.

**Estimated contribution to value added at Kangu.** The BWRP Project Completion Report estimated a direct cash inflow exceeding A\$2.0M across the project period,

money which went to landowners for materials royalty, labour, fuel, food and accommodation. Using a 20 percent value added multiplier for the periods during which the expenditures were undertaken and discounting the benefit stream at 6 percent per year, a net present value of \$1.5 million or \$1.4 million is obtained if discounted at 9 percent p.a.

**Efficiencies due to better infrastructure at Kangu.** Prior to construction of the Kangu facility, cargo had to be transferred by small craft to ships anchored offshore. This was both a bottleneck and resulted in spoilage, estimated at a remarkable 40 percent by the proponents of the wharf.<sup>118</sup> Construction of the Kangu facility has reduced this double handling to a single loading process resulting in an efficiency gain of 20 percent. Section 3.3.2 estimates that 1,000 tonnes of cocoa are currently shipped from Kangu. Applying a 20 percent efficiency gain to this volume and limiting the benefit stream to ten years (to reflect deterioration in the facilities) will result in an estimate of benefits in present value terms of \$1.6 million (9 percent discount rate) to \$2.1 million (6 percent discount rate). This is well below the cost. Lessons from this are discussed in Section 5.

### 4.2.3 Cocoa dryers and the rural development trust fund

The cocoa dryers projects and the rural development trust fund are classified as small-scale income generating projects. Sections 2.4 and 3.4 cover BCCDRP project details. The foregoing estimates have indicated that RWA benefits have substantially exceeded the costs. A CBA of the BCCDRP projects will not influence this outcome as this investment accounts for only around one tenth of AusAID project expenditure of relevance to this CBA. However, assessing their performance is important for understanding the viability of the income generation activities undertaken by the BCCDRP.

#### *Cocoa dryers*

Among the small-scale income generating projects, the cocoa dryers were the most successful. The dryers relieved capacity constraints, facilitated the growth in exports and ensured that cocoa producing households captured an increased share in the income from exports when compared to the earlier plantations.

The distribution of small dryers through the BCCDRP widened the base of the cocoa processing economy not only by increasing the number of processors, but also by permitting a significant group of new entrants into the field. Further, the small dryers helped mobilize family labour and engaged households in the cash economy. This is likely to have impacted significantly on rural incomes as well as on marginal rural employment.

#### *RDTF projects*

AusAID funded a number of small businesses under the rural development trust fund, aimed at improving livelihoods through sustainable incomes. A feature of small business projects in Bougainville is that they are supply-side interventions, the success of which depends on the existence of a cash economy or ready markets for the goods produced.<sup>119</sup> In Bougainville, the assumption of sufficient and regular effective demand was over-optimistic for some of the markets targeted by the small projects. The available evidence indicates that only a small proportion of the projects (excluding the dryers) produced sustainable incomes.

In contrast to the dryers, the failure rate of the other small income producing projects has been very high, as discussed in Section 3.4.4. To recap:

- Piggeries – pigs are fattened in pens but tend to be slaughtered for domestic consumption and not sold
- Poultry – a high failure rate due to weaknesses in the supply chain
- Ovens for bakeries – there was a high ‘commercial’ failure rate due to a lack of effective demand although the ovens continue to be used socially, e.g., for family or church gatherings.

The cocoa tools projects which distributed small agricultural tools to households complemented other cocoa and copra projects undertaken by various donors. The benefits generated by these in the form of increased cocoa earnings have been covered earlier.

While there are no figures indicating the number of projects that have survived, anecdotal evidence suggests that a few are still in operation. A conservative assumption that 5 percent of the 1,997 projects funded were successful, suggests that around 100 viable small scale businesses were created.

The Project Completion Report’s estimate that a project could provide a net income of 500 kina per year for ten years is plausible. Through discounting future earnings, total benefits from small businesses is estimated at between \$0.1 and 0.2 million.

Consistent with the other value added calculations, a value added multiplier of 0.2 (or 20 percent) for the years in which the spending was disbursed is adopted. The result is a net present value benefit estimate of \$1.0 million (if benefits are discounted by 9 percent p.a.) to \$1.2 million (with a 6 percent discount rate).

#### **4.2.4 Attributing cocoa export benefits to individual projects**

Section 4.1.4 found that the projects when considered together the cumulative benefit from increased cocoa exports outweighed the costs of the RWA projects. A question remains as to the relative cost-benefit performance of roads, wharves and agriculture for increase in cocoa exports, when they are considered as separate projects. There are problems with such a component-level approach. As each of these projects is critical to the cocoa market chain to the extent that any one broken link leads to a severe drop in the amount of cocoa sold (see Section 3.5.1), attribution of one link as having more monetary benefit than another is questionable. Ascribing equal contribution to each is similarly contentious as it ignores the shares of other inputs such as labour, cocoa trees and dryer firewood.

This conundrum highlights the reason why it is better to consider the benefits arising from the market chain as a whole (cumulative benefits) as was done in Section 4.1.4, rather than in parts. Despite this, judgements as to the relative value of each component are unavoidable, as in the case of the AusAID wharf projects which are generally seen as poor contributors to the overall benefit. To partly address this question of component value, a breakeven analysis is presented here.

##### *Breakeven analysis*

On the question of value delivered by each project, a ‘breakeven’ analysis provides some useful insights. A programme may be said to have broken even if the total benefits generated equalled the costs incurred (i.e., a benefit-to-cost ratio (BCR) of one). Given that a total stream of benefits worth \$81.4 million was identified in this CBA, the

following proportions of benefits would have to be attributed to each programme in order for it to break even:

- BCTRRP – breakeven share of benefits = 16%
- BCTRMP – breakeven share of benefits = 30%
- BCCDRP – breakeven share of benefits = 9%
- BWRP – breakeven share of benefits = 17%

This means that if the roads projects together can claim 46 percent of the benefits generated, they would have broken even – if one were to attribute more than 46 percent of the benefits to the roads projects, then these would record a BCR greater than one.

Similarly, the share that needs to be attributed to the dryer projects would have to exceed nine percent for a positive BCR. In this respect, it is noteworthy that previous analysis by McGregor suggests attributing 10-20 percent of additional cocoa revenues to the dryer projects.<sup>120</sup> This would suggest that the dryer projects had clearly broken even and generated a positive BCR.

Finally, breakeven analysis of the wharves projects suggests that one would have to attribute 17 percent of the benefits to these projects to produce a positive BCR. Such an attribution would appear extremely unlikely given the discussion in this report.

As a double check for the wharves, another type of breakeven analysis may be offered. This asks how much *additional* cocoa would have had to be exported through the wharves to recoup the initial outlay (or sunk cost). Using a ten year project horizon, it can be shown that:

- Buka wharf would have had to directly generate an additional 200 tonnes of cocoa per year in order to break even
- Kangu wharf would have had to directly generate an additional 460 tonnes of cocoa per year in order to break even

It would appear that Kangu wharf is therefore the least likely to break even under the assumptions of this CBA.

### 4.3 Policy for future road maintenance funding

The CBA did not consider future recurrent cost financing (RCF). The manner in which the key benefit of increased cocoa exports was estimated reflects this omission: the ‘with aid’ and ‘without aid’ scenarios converge by around 2022 (see Section 4.1.2), because roads and other infrastructures will deteriorate without maintenance.<sup>121</sup> In terms of Figure 37, RCF would work in the direction of shifting the ‘with-aid’ curve above the ‘counterfactual’ for a longer time.

Whilst the projects reviewed here have set a strong foundation for achieving longer-term economic outcomes, without maintenance funding the benefits will not translate into sustained economic growth i.e. over and above what may have been achieved counterfactually by Bougainville.

Bougainville’s own future ability to finance replacement road-building equipment and the shortage of graders in the absence of predictable cash flows is a matter of concern. With aid-financed maintenance, local activity is dependent on external budget and policy decisions. At the time of this research, the contract was near its end and no ongoing source of road maintenance and financing had been identified. News that AusAID had approved maintenance funds came through only at the last minute.

One option would be for GoPNG or the Autonomous Bougainville Government to make budgetary provisions. The Bougainville government received very little revenue from the road transport allocation – 100,000 kina from value-added tax in 2005 (Budget estimate) and 100,000 kina from vehicle registration fees (many vehicles are unregistered). Such amounts are clearly inadequate for sustainably funding road maintenance in Bougainville.

A second option is to establish a road maintenance fund. Discussions with a Bougainville government economic adviser<sup>122</sup> suggested that the PNG government is considering this funded through a road user tax. A further option is that a roads fund could be financed with an ‘earmarked’ fuel tax or an export levy, and another basis for funding maintenance is conceivable through export levies.

Section 4.1.4 mentioned a cocoa ‘stabilisation’ levy introduced in 1999 to repay an EU loan to stabilise local cocoa prices in the 1990s. With the final tranche of the EU loan now written off, the stabilisation levy has been suspended, but a similar levy would offer an avenue for road maintenance. A levy of K20 per bag of cocoa would yield nearly K5 million for an export crop of around 15,000 tonnes, sufficient for priority road maintenance projects. If an annual road fund target was set, the levy could be adjusted to ensure that this target was met.

A counter argument is that levying this charge on cocoa would appear to penalize the cocoa sector. However,

- the cocoa sector has been the key beneficiary of the projects
- it would be a pragmatic measure
- it would be possible to widen the financial base for such a road fund as other sectors of the economy open up.

**Table 29. CBA results using 6% and 9% discount rates**

	Benefits, baseline (6% discount rate)	Benefits, sensitivity (9% discount rate)
	\$ million	\$ million
<u>Cumulative impact</u>		
Cocoa exports brought forward	66.3	50.5
<u>Stand-alone impacts</u>		
a. Roads		
Travel time savings	3.1	2.6
Consumer surplus	2.7	2.3
Value added contribution	4.3	3.9
b. Wharves		
Spoilage	2.1	1.6
Value added contribution	1.5	1.4
c. Driers and micro-credit		
Sustainable incomes	0.2	0.1
Value added contribution	1.2	1.0
Total benefits (NPV)	81.4	63.5
Total costs (NPV)	47.4	42.8
<b>Benefit-to-cost ratio (BCR)</b>	<b>1.72</b>	<b>1.48</b>

A fuel tax, levied at the wholesale level, would relate more directly to the road use that is the reason for the maintenance.

Either method would be a positive step towards local sustainability, even though the economy may still be only strong enough to cover part of the maintenance cost, the remainder requiring the in the meantime. A stable roads fund mechanism would:

- reduce the impact of government budget uncertainties, whether in Australia or PNG
- link the revenue sources to the main related income source(s)
- be simple to administer, with little risk of fraud as there are only one or two major fuel wholesalers and cocoa bulking points on Bougainville.

## 4.4 Conclusions of the cost benefit analysis

This CBA suggests that the measurable economic benefits to Bougainville from the projects significantly outweighed the costs. The results have been tested through (at times very) conservative assumptions and sensitivity analysis. The overall benefit cost ratio (BCR) is estimated at 1.72 under our baseline assumptions; a ‘commercial’ discount rate reduces the BCR to 1.48 (see Table 29). The internal rate of return (IRR) comes to 22 percent under both sets of assumptions.

Some ‘cumulative’ benefits (e.g., in horticulture) could not be quantified. Quantification of the aggregate impact of the projects on copra production could also not be undertaken due to a lack of data and conflicting evidence.

The single largest ‘cumulative’ benefit from the four projects was accelerated cocoa exports, i.e., bringing forward production by several years. This benefit alone outweighed costs under all but the most conservative (and implausible) assumptions about benefit attribution to AusAID.

Under the baseline assumptions, which accepts that half of the cocoa benefit can be justifiably attributed to the AusAID intervention, this benefit alone is valued at \$50 million to \$66 million (see Table 29). These benefits by themselves outweigh the costs incurred by AusAID.

The stand-alone impacts were however also significant, although not of the same order of magnitude as the above mentioned cumulative impacts. Stand-alone impacts were estimated at \$15.1 million. If AusAID’s investments were evaluated purely on the basis of the stand-alone benefits, the BCR would have been negative.

Finally, the benefits considered here do not include recurrent cost financing (RCF). Current and future RCF will need to be evaluated independently; RCF expenditures over the next 15 years can shift the ‘with-aid’ curve in Figure 37 upwards so that benefits would arrive later than projected.





**Hill village, Togerau feeder road**



# 5 Lessons learnt

THIS SECTION DRAWS OUT LESSONS AND RECOMMENDATIONS from the implementation of roads, wharves and agriculture projects in post-conflict Bougainville. It discusses the lessons learnt from the individual projects covering aspects that have worked well and where better results may have been obtained. Consideration is given to the strengths of market-chain assistance in the post-conflict setting as well as the additional strengths of transport infrastructure for civil rehabilitation. Substantive conclusions from the social impact evaluation have been covered in Section 3.6, and conclusions from the cost benefit analysis in Section 4.4.

## 5.1 Lessons from the social impact evaluation

### 5.1.1 Arterial roads

**Local Capacity Building:** The roads projects were implemented through local rather than foreign contractors and imported equipment and led to the strengthening of local road building capacity and a reduction in costs.

**Community Integration:** The use of community road teams has both lowered the cost of road maintenance as well as the potential for the roadblocks observed in some areas of the south where support for the road is viewed through a lens of confrontation.

**Peace Facilitation:** The improved mobility afforded by the road has increased community activities and strengthened social capital. This has taken two forms: a) direct peace-building activities such as reconciliation meetings, governance meetings of Councils of Elders, various committee meetings, meetings of service organisations such as NGOs and church groups, b) sports activities. Community networks are beginning to extend beyond the small-scale clan association.

**Social Marginalization:** The emphasis on trunk road rehabilitation to the exclusion of feeder roads has left some groups marginalised. A supportive feeder roads program would have linked many adjoining populated areas to the trunk road.

**Project Planning and Documentation:** A short gestation between concept and implementation in the original road project, achieved by moving quickly from decision to implementation as demanded by the situation, exemplifies good practice. Ironically, it also meant that instruments such as the feasibility study and the design document that would have otherwise provided a baseline for measuring the performance of this project against the original objectives were not prepared. It is recommended that in rapid response situations, the scope of services should require the activity contractor to establish baseline information early in implementation.

### 5.1.2 Wharves

Wharves rehabilitation in Bougainville departed from the *de facto* model for market chain rehabilitation. Donor funding for wharves was not allocated proportionate to their service potential. Considerable resources were allocated to the container facilities for inward goods at the relatively less significant port of Buka. On the other hand, the

important main cocoa wharf at Kokopau has received no consideration. Similarly, no attention has been paid to constructing the landing and other facilities at Torokina or Wakunai widely understood as important for cocoa shipments. Underlying this was the lack of a clear Bougainville-wide transportation strategy that prioritised shipping facilities in relation to roads and crop production areas.

### 5.1.3 Agriculture and micro-enterprise activities

**Cocoa mini-dryers and dryer rehabilitation:** Demand for these was high as dryers were supplied at a heavily subsidised price which ordinary farmers could afford and many smallholder cocoa farmers were attracted to the high prices obtained if they can dry their own cocoa. Positive results have been obtained from the mini-dryer program where potential cocoa yields are good and farmers have transport access to market. Where the yields are low or transport not available, dryers are under-utilized.

**Capacity over-utilization** of the dryers in high-yield, transport-connected regions has led to their early deterioration which should be addressed urgently. Quality concerns also remain due to overuse of the limited dryer capacity available. The appropriateness of dryer size and their ancillary support requirements will need to be investigated in the context of the household economy and cultural practices.

**Metal workshops** were commissioned in Bougainville specially to fabricate mini-dryers have stimulated manufacturing, generated jobs and diversified to fabricate a range of items. However, financial capacity issues and doubt whether farmers will buy spare parts has led some shops to not stock manufacturing supplies such as sheet metal. Unavailability of dryer repair services affects the sustainability of the dryers and risks putting those in need of repair, into disuse.

**Wood fuel and mini-dryers:** The BCCDRP assumed that the wood fuel requirements of the mini-dryers were identical to those of the larger dryers and promoted a seedlings program unnecessary for the mini-dryers, which use garden regrowth softwoods. The introduction of new technology should be preceded by an investigation to determine its operational needs.

**The seedling distribution program** was uncertain about its objectives and did not heed the advice of the NFS to treat the seedlings program as a separate component. The assumption that planting and maintaining of trees were the responsibility of each cocoa dryer beneficiary, did not take into account either their skill or willingness to do so. Inflexibility in this component and lack of review, probably due to ineffective monitoring, led to a missed opportunity to redirect the scheme into smallholder forestry projects.

**Farmers are reverting to the traditional varieties** of cocoa from the high-yielding UNDP varieties that were expected to boost production because of unsustainably high labour requirements of hybrids. Diffusion of innovation should consider the household economy and the labour, resources and time required to adopt them successfully.

**Trust fund micro-enterprise activities** have performed poorly due primarily to market chain weaknesses, critical management factors and cultural issues. Small enterprises such as poultry, piggeries, cocoa tools, bread-making drum ovens and fishing equipment have largely ceased to operate on a commercial basis. In regions where cocoa export income is low, micro-enterprise struggles to find an adequate market, suggesting the need for monitoring of the relationship between the primary market chain income stream and viability of downstream business relying on this income.

### 5.1.4 Project design and implementation

The four projects considered by the study have complemented each other but were not parts of a common design. Among others, this is evident in the content of activity reporting and the absence of cross-sectoral data interface. To achieve better future integration, weaknesses in the linkages between agriculture, infrastructure and political stabilization should be identified, and location and sector specific approaches developed within a common performance framework.

## 5.2 Lessons from the cost benefit analysis

The CBA has independently identified a number of lessons for future projects. Some of these confirm those arrived at from the social impact analysis. Notably it has found that the establishment of an economic baseline at design would assist in project selection (including identification of economic projects) and the measurement of impact. It has also found shortfalls in not considering transport projects holistically. Finally, it makes a case for a road fund to be established in Bougainville for future road maintenance.

### 5.2.1 Need for cost-benefit evaluation at project design stage

Where infrastructure and agriculture projects are designed as parts of a common framework, the freight economics relating to the balance between the different transport links and the spillovers between the projects should be considered at design. Project Design Documents should include an economic evaluation to ensure that the alternatives have been examined. Basic cost-benefit calculations should be attempted, if only aimed at broad magnitudes.

- For example, a prior investigation of options for the road project would have confirmed 1) the value of rehabilitating the Buka and Bougainville trunk roads (not only for facilitation of exports but also for increasing school attendance, policing, etc), 2) the case for the Queensland rural roads standard, 3) the case for postponing bridges and feeder roads and 4) the need to provide for ongoing maintenance.
- Such a study would consider whether to lower the standard for less used sections of the trunk network and whether to include the paved roads near Arawa. The option of upgrading some feeder roads and improving access to the smaller local ports, i.e., for direct unloading into landing craft could also have been considered.
- Sound cost benefit analysis of the wharves projects would have considered wider transport issues and alternatives (i.e. do nothing, do less or do something else). A considerable waste of resources might thus have been avoided.

### 5.2.2 Cost-benefit shortfalls of non-integrated design

It would be desirable where appropriate to design infrastructure and agricultural investment projects collectively rather than as individual projects under common but abstract objectives. A holistic view of all related aid projects is preferable to a “silo” approach. Some notable instances highlighting this need were as follows:

- despite a well justified decision not to proceed with the originally proposed wharf at Mamagota Beach, the access road to that beach was rehabilitated regardless;

- the Kangu Beach jetty was constructed in part to avoid the cost of trucking to Kieta, yet the implied reduction of traffic between the south and Kieta was not considered in the road project (note that there is a social justification for that road never the less);
- there appears to have been no consideration of whether money was better spent on roads or wharves. From the incomplete information available, there are questions as to whether better value-for-money could have been obtained by spending some or all of the Buka wharf money on 1) fixing the paved roads and/or 2) rebuilding the relatively busy and structurally unsound section of road south of Kokopau and/or 3) building a barge to carry freight from Kokopau to Buka wharf;
- in some instances, a degree of ‘over-engineering’ is evident. At Kangu, for example, the landing craft ramp was justified, but the large jetty and storage shed was not.

Provision should be made in future, to gather information for judging project performance both to enable adjustments during implementation as well as lessons for other projects.

## 5.3 Lessons for post-conflict assistance

Other than lessons learnt for further AusAID assistance in Bougainville, some lessons have relevance to future peace restoration efforts in other situations.

### 5.3.1 Market chain rehabilitation

The rehabilitation of Bougainville’s smallholder agricultural export sector through assistance to the market chain has been valuable. Market chain rehabilitation involved rehabilitating smallholder cocoa trees, crop processors, road networks and wharves for shipment (see Figure 4 in the introduction). This integrated approach has assisted smallholder farmers in large areas of Bougainville to refocus on their farms for income which has in turn encouraged peace. The projects combined have facilitated family and community projects with the money gained from agricultural produce. Smallholder market chain rehabilitation has been the principal foundation for all of the post-conflict interventions applied following the establishment of initial peace monitoring. Some lessons from the Bougainville experience are outlined below.

#### *Relation of market chain to household income and peace-building*

Using a geographical approach to distribution of socio-economic impact through the market chain, the study isolated the effect of varying levels of cocoa potential and transport access. The lessons were clear:

- Cocoa yields, and hence overall levels of household income, were sensitive to the coherence of linkages between each of the three elements of smallholder market chain supply rehabilitation
- All three links in the chain: fulfilling cocoa potential by crop rehabilitation, rehabilitation of crop processing facilities and rehabilitation of transport access to market, are essential
- Assuming crop processing capacity is available everywhere, gross income is only high where both cocoa potential and transport access is also high.

- Growth in household income appears to be a necessary but not sufficient condition for peace building and economic impact is interdependent with civil society and governance factors
- An increase in household income in terms of traditional economy may be an equally effective means to building wellbeing and social cohesion

#### *Performance-linked strategic approach necessary*

Market chain rehabilitation in Bougainville was intuitively adopted in the overall post-conflict response in Bougainville. However, it was not a strategy integrated within a logframe and linked to performance objectives. A lack of strategic focus led many projects to work independently of each other and without overall coordination or vision. Market chain rehabilitation has been demonstrated to be effective in the Bougainville case. A clear performance linked strategy would have assisted in providing more even results across Bougainville.

- As a general strategy for post-conflict situations, the SMC should appear as a principal objective and placed between the ‘goal’ and the ‘objectives’ in the logframe.

#### *Impact evaluation of governance and civil society assistance*

The model developed through this study for SMC rehabilitation reasons that an increase in household income is necessary but not sufficient for restoring peace. The model predicts that the impact of SMC on peace is interdependent with civil society and governance inputs.

- Impact assessment of the post-conflict civil society and governance programs in Bougainville are needed to determine the inter-relationships and significance of civil society and governance programs, to derive lessons for future implementation of a fully integrated post-conflict peace-building assistance strategy.

## **5.4 Building on market chain rehabilitation in Bougainville**

Economic development through market chain rehabilitation undertaken so far in post-conflict Bougainville has had uneven results. In those economic regions where either cocoa yields are low, or transport access has not been provided, economic recovery has not been significant. In the one region where assistance has led to both high cocoa yields and good transport access, economic recovery has been excellent.

### **5.4.1 Broad economic policy options for Bougainville**

Smallholder market chain rehabilitation in post-conflict Bougainville, provided by Australia and the other donors and banks in the post-conflict period, has not addressed specific regional differences and may have encouraged a pattern of uneven regional development. This study recommends that the strategic framework of SMC is retained for now, but that it now be modified to a regionally targeted approach to redress the imbalances.

Two broad options follow on from the findings of this study for building on Australia’s RWA assistance in Bougainville. They are:



- Enhancing economic development in regions where economic recovery has been successful (northeast Bougainville), and
- Assisting economic recovery in those regions where economic recovery has not yet been successful (south Bougainville, the west coast, Buka rural)

The above positions are based on the following arguments:

- Enhancing development in the northeast is a rapid way to increase Bougainville's gross domestic product, aiding both government and business
- Assisting economic recovery in poorer areas, especially the highly populated and tension-prone south, will reduce the uneven development that may threaten the stability of Bougainville as a whole in the medium to long term.

These arguments imply that a balance in economic policy is necessary. If development is allowed to race ahead in the northeast, the regional wealth gap will open wider, fanning tension in an already fragile state. If economic assistance is only delivered to the poorer regions, increased revenue from opening all available economic channels is denied. Therefore, a middle path is recommended.

### *Is it best to wait for mining?*

The currently closed Panguna copper mine forms a backdrop to all discussion of economic recovery, for the south in particular. If the mine were to reopen, Bougainville's economic landscape would change radically and revenues from agricultural export would become a minor element in the GDP. Mining would also lead to upgraded facilities nearby and deepening of the skills base.

It should be remembered that the mine was the original flashpoint of armed conflict in Bougainville. It is still a no-go zone, populated by armed militants who spurned invitations to the peace agreement and whose present relationship to ABG is fragile. Their attitude to profit-seeking foreigners is dour. While some think that reopening the mine is possible, it is just as likely that any agreement would again collapse. In the interim, a strategy for economic recovery through agricultural production appears the most viable among the possibilities.

Resumption of mining must also be weighed against the stress this would place upon Bougainville, which at this stage has all the characteristics of a fragile state. Influx of workers from elsewhere in PNG, the politics of royalty distribution and the political imperatives of a new and powerful stakeholder, the company, may create political shocks in Bougainville to destabilise the island in the run up to the autonomy referendum due between 2015 and 2020.

### *Options for assistance to individual regions of Bougainville*

The following discussion examines the options for economic assistance in the four economic regions of Bougainville: northeast, south, west coast and Buka. The recommendations are focused on agricultural export as the centre-piece of an economic strategy. The recommendations for regional assistance draw on the findings of the study and do not cover options beyond these. Many options are presented, which reflects the sense of unfinished business in post-conflict development of Bougainville.

### 5.4.2 Addressing underdevelopment in the South

The South and West coast areas are in most need of achieving parity with Buka and the Northeast. The factors identified that have lowered the impact of RWA assistance in the South districts of Arawa, Buin, Siwai and Bana are:

- A drop in cocoa yield well below pre-crisis levels. Local informants attribute this to changes in rainfall patterns affecting flowering and more prevalence of drainage-related tree diseases
- A relatively high proportion of population in the south living in remote and semi-remote areas without good access to the trunk road
- Lack of income and high youth unemployment mainly as a result of failure of export crop production, due to low cocoa yield, failure of marketing for the alternative crop (vanilla) and lack of remote area road access for potential crop rehabilitation
- Resurgence of conflict in the south since 2003, involving the failure of reconciliation around the intense civil war in the south, the rise and transformation of the Me'ekamui movement in the post-conflict period and the failure of weapons disposal to remove the bulk of military weapons from the south
- High rates of illiteracy and skills shortages among young adults due to closure of schools in the south throughout the crisis
- Out-migration to escape economic hardship and violence leading to a skills drain in the south.

Assistance to remedy these problems in the south will require work beyond RWA assistance. An initial set of options are:

- **Multidisciplinary study of export crop rehabilitation and diversification in south Bougainville.** No comprehensive field investigation has yet been undertaken of the difficulties of restoring cocoa yield in the south. As an immediate priority, options in the south for the remediation of cocoa and/or development of alternative export crops and their markets should be established.
- **Coordinated multi-stakeholder approach to resurgence of violence in south Bougainville.** The fragile political situation with a focus on governance and civil society can only be approached with the full cooperation of the ABG. Apart from the ABG and AusAID's Law and Justice sector program, a range of local NGOs including church-based and women's groups are working to reconcile the south and seek further assistance.
- **Youth literacy and skills needs assessment in south Bougainville.** Adult literacy and skills development will involve stakeholders such as the community development NGOs and ABG departments including those responsible for general educational training, health awareness and agricultural training.
- **Selective feeder road rehabilitation in south Bougainville.** Feeder road rehabilitation has been planned by ABG but its budget is insufficient and it is not clear if the clusters of remote communities in the southern districts are being targeted in the plans. Feeder roads may be considered a medium term priority because immediate transport infrastructure rehabilitation will not greatly influence export production in the south until export crop rehabilitation and/or diversification is underway.

Investment in the movement of the capital of Bougainville back to Arawa may restore Kieta port to its previous status as a major export port for south Bougainville and possibly strengthen agriculture in the surrounding area. This may serve to support stability and confidence building in south Bougainville.

### 5.4.3 Enhancing development in the Northeast

Economic development in the northeast places it ahead of other regions in Bougainville. Although increasing the wealth gap between the regions of Bougainville may exacerbate tension, in tandem with addressing development in other regions it will increase overall revenue. A number of aspects to economic development in the northeast are proposed, some of which require more detailed feasibility study. They may best be brought together under a single terms of reference.

#### *Agriculturally productive feeder roads*

Cocoa production in the remote areas of upland Tinputz and Wakunai where production potential is high, is constrained by a lack of feeder road development.

- **Selected feeder road development in Wakunai and Tinputz.** In a model similar to the trunk road, local contractors and community road teams can carry out works.

#### *Agricultural shipping*

Improvements to agricultural shipping in the northeast may be economically justified. This would involve further consideration of agricultural shipping options for:

- Wakunai landing
- Kokopau wharf
- Buka passage vehicle ferry (between Kokopau and Buka) that potentially makes better export use of the Buka container wharf

Transport economics and engineering inputs and an exploration of land tenure and stevedoring arrangements would be required. Wakunai landing, which is located within the cocoa belt, may relieve the heavy road freight maintenance costs to the trunk road at relatively low cost. Wakunai requires an upgrade of the barge landing, provision of a hardstand, gabion breakwaters and small goods shed.

#### *Plantations*

This study recommends a deeper multi-disciplinary assessment of the impediments to restoring production in the previous plantation areas and how they can be overcome in the current political context of Bougainville before further action is contemplated.

#### *Market towns*

The economic success of RWA in the northeast has created opportunities for extra services, predominantly in retail. Small market town development at the Tinputz and Wakunai district stations needs land tenure and town governance arrangements resolved before private business can confidently invest in these centres. Both places also require market pavilions.

- **Report and recommendations for market town development in northeast Bougainville.** This would require anthropological, legal and economic inputs,

and thorough consultation with all identified relevant stakeholders, focusing particularly on land tenure issues.

#### *Managing in-migration tensions*

In the northeast, in lieu of suitable tenure arrangements, entrepreneurs and cocoa farmers from the south are attracted by retail opportunities and land in unused plantations. The situation is not well managed and ethnic tensions are rising. This south to north migration is in part an unintended consequence of uneven RWA impacts. Long term economic improvements in the south may lower migration incentives. In the short term, an approach to easing tensions and managing central place formation can be explored with the stakeholders. Toward this,

- **Widen the study proposed above to cover in-migration ethnic tensions.** This would extend the consultation with stakeholders.

### **5.4.4 Addressing underdevelopment on the West coast**

Torokina district is entirely isolated from the agricultural markets but has a large hinterland of very high agricultural potential. The people of Torokina identify inadequate transport as the single outstanding factor that has lowered the impact of RWA assistance. Wharf rehabilitation was planned by EU but works were never implemented. As an initial step undertake

- **Torokina transport needs and feasibility study.** Transport economics and engineering assessments will be required, as will consultation with stakeholders from ABG, Torokina local level government, Council of Elders and local shipping agents.

Provision of transport services to Torokina is a high priority.

### **5.4.5 Development in Buka**

Buka contains about one quarter of Bougainville's population, most of this in rural areas. Gross per-capita agricultural income is low. It is not a major producer of cocoa, and about half its gross per-capita agricultural income is derived from copra. Buka is now strongly dependent on Buka Town because the town has been developed during and after the crisis in preference to the old capital of Arawa. If the capital were moved back to Arawa as mooted, the economy of Buka would collapse. Therefore, Buka must diversify its economic base.

#### *Coconut oil fuel production*

Buka has one potential emerging industry i.e. coconut oil fuel production. Coconut oil can be used as a diesel replacement in vehicles and diesel electric generators. A crushing plant was started in Lontis at the end of 2003 by BMF Enterprises, and in 2006 was producing around 8,000 L/month, mainly for local vehicle consumption. It is a sustainable industry given appropriate management and technical inputs. Coconut oil fuel holds significant promise for diversifying Buka's economic base, adding value to Buka's coconut plantation assets, reducing Bougainville's fuel imports and potentially becoming an export earner. As an initial step:

- **Scoping for assistance to expand coconut oil fuel production in Buka.** This would involve economic and technical assessment and consultation with ABG, current producers and growers.

This is a medium-term priority.

#### 5.4.6 Support for overall economic growth

Apart from regionally targeted assistance to complete work begun under RWA assistance, assistance is also required across Bougainville as a whole.

##### *Consolidation of cocoa processing capacity*

Although BCCDRP distributed dryers approximately evenly across Bougainville with regard to tree stock, it did not distribute enough of them in high yield areas to prevent overuse. The dryers that have been distributed are due for refurbishment. Local manufacturing and refurbishment will generate work and income flows to the small manufacturing and repair businesses. This is a priority issue.

- **Finance for new dryers.** Current constraints to credit access and savings facilities threaten sustainability of the cocoa dryer projects. Strengthening of finance/microfinance institutions on Bougainville is needed if smallholders are to have adequate funds to further invest in cocoa processing facilities.
- **Support for a cocoa dryer repair program.** Consultation within Bougainville will be required to adopt the best approach, e.g. subsidy or micro-credit, to ensure manufacture is stimulated.

##### *Cocoa industry regulation*

Rehabilitation of export agriculture in Bougainville through Australia's RWA assistance did not consider support for marketing arrangements and support for industry regulation. This has some consequences for cocoa quality and associated 'grey' and 'black' markets in cocoa. A more workable system of quality regulation involving local stakeholders may be desirable. The initial recommendation here is

- **Develop a plan for effective cocoa industry regulation in Bougainville.** This would involve stakeholders including the Cocoa Board, ABG Department of Economic Services, Councils of Elders, cocoa fermentary owners and cocoa dealers.

##### *Roads Maintenance Fund*

Whilst the RWA projects have set a strong foundation for achieving longer-term economic outcomes, without maintenance funding the benefits will not translate into sustained economic growth. With aid-financed maintenance, local activity is dependent on budget and policy decisions made abroad. A more sustainable basis for road maintenance has been made possible by the increased cash income from exports. A fuel levy, easy to administer at the wholesale level, would offer a potential avenue through which funds for road maintenance could be raised. If an annual road fund target was set, the levy could be adjusted to ensure that this target was met. With crop volumes expected to grow, the levy could consequently drop over time. An initial option is:

- **Scoping for feasibility of a roads fund in Bougainville to fund road maintenance.** This would involve economic assessment, ABG, National Roads and technical input from the trunk road managing contractor in Bougainville.

Full detail of this proposal is presented in Section 4.3. Priority for this proposal depends on the timeframe of currently pipelined maintenance funding by AusAID.

### *Economic mapping and modelling for future programs*

This study has demonstrated the geographic dimension of economic development and service provision in Bougainville. Bougainville lacks the spatial information for further planning of roads, wharves, agriculture, settlement and for addressing economic inequality in the west and south of Bougainville. During this study some data on educational facilities, health facilities and road facilities was assembled into GIS systems compatible with existing government GIS databases. Additional data may begin with feeder roads, locations of fermentaries, and quantities of cocoa and copra from geo-located buyer records.

- **Economic resources and services mapping.** The stakeholders in this exercise are the ABG administration, particularly the Division of Economic Services, Division of Health, Division of Education, Cocoa Board, the local level governments, Councils of Elders, church agencies, National Mapping Bureau and the National Statistics Office.

Field surveys would involve the cooperation of the LLG district administrations that are likely to actively support a mapping of their economic resources and services. A relatively low-cost exercise, this would be complemented by:

- **Economic data collection and analysis for modelling.** More complete data for Bougainville, particularly for household income, agricultural production costs, more accurate outwards shipping volumes, business surveys and government/NGO employee numbers are required for better economic modelling.

This mapping and modelling exercise would prepare an economic atlas for Bougainville. Building on this, case studies of the interface between infrastructure, agriculture and the wider economy are recommended to prepare an evidence-based platform for planning broad-based development in Bougainville. Such studies should be undertaken both in the northeast and the south. A focus on how the south can be drawn into the economic and political mainstream is recommended.

## **5.5 Reflections on economic strategy for Bougainville**

It is appropriate to close this report by considering the role of Australia's post-conflict assistance within a broader, future-looking timeframe. The strategy of smallholder market chain (SMC) rehabilitation for post-conflict peace building has supported Bougainville's agricultural export recovery, by an appropriate focus on infrastructure delivery through the RWA projects. Market chain rehabilitation has not addressed regional differences in Bougainville and consequently its success has been tempered by the emergence of a pattern of uneven development within the province.

Bougainville is still in a phase of post-conflict recovery, but this state of affairs will not continue indefinitely. Post-conflict rehabilitation in Bougainville will need to be replaced by a new forward looking strategy with broader reach. Prior to this however, there needs to be a final transitional phase to address the uneven development that has arisen. Addressing this disparity is the unfinished business of market chain rehabilitation in Bougainville.



Beyond this final transition phase for market chain rehabilitation, a major factor in Bougainville's future is the independence referendum to be held between 2015 and 2020.<sup>123</sup> Either continued autonomy or independence will be the outcome of the referendum. In either case, *a new forward-looking strategy will need to emphasise Bougainville's capacity for economic governance*. This will transcend the RWA project's focus on infrastructure. Until the referendum outcome is known, a conservative strategy that should be followed which:

- engages with all of Bougainville's geographic regions and people
- maintains stability during the pre-referendum period through diversification and decentralization
- achieves a mix between traditional (subsistence) / modern (export) economy. Rural economic diversity should focus on the smallholder and reduce reliance on any one export market. Service delivery through networks involving government, business, grassroots and intermediary organisations should be progressively strengthened.
- stimulates growth to meet development goals (e.g. MDGs) in both economic and human development terms to improve wellbeing in Bougainville.
- recognises that while Bougainvilleans need household cash income, quality of life in Melanesia and its civil society rests on the strength of traditional social and economic bonds.

While emphasizing Bougainville's capacity for economic governance the strategy should base itself on the particular circumstances that confront Bougainville, some of which have been investigated by this study.

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# 7 Endnotes

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- 12 ‘Australian Agency for International Development, Bougainville Wharves Rehabilitation Project, Project Design Document (Tender), September 2000’.
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- 16 Proposed also were six market centres with facilities for women and managed by women. The market facilities partially eventuated (Arawa, Buin and Buka markets) under EU funding.
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- 19 Immediately after harvest cocoa beans require correct fermenting. This imparts the chocolate flavour. The beans are then dried to stabilise the fermented beans from decay. The processing facility comprises both a fermenting box and a heated drying bed, usually incorporated in one building. Fermenting involves keeping the beans in the fermenting box for a few days. The fermented beans are then turned out onto the heated dryer bed. Heating is by use of a wood-fired furnace under the dryer bed, sometimes with exposure to sun as a secondary drying method. The volume of the fermentary box is matched to the area of the dryer bed. The whole facility might properly be called a fermentary/dryer but is often referred to as either a 'dryer' or a 'fermentary' for convenience.
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- 24 Copra: Fair merchantable price data provided by KIK, February 2007. Cocoa: Average monthly purchase price (DIS), major exporters for export quality cocoa for 2000-2005 from 'Cocoa Statistics of Papua New Guinea', Economics and Statistics Section, Cocoa Board, Rabaul; for 2006 derived from Cocoa Board spreadsheet of daily DIS for Rabaul dealer/exporters.
- 25 Copra: fair merchantable standard (FMS) monthly average prices supplied by KIK (Port Moresby), averaged over 2006. Cocoa: delivered –in– store (DIS) monthly average prices supplied by Cocoa Board (Rabaul) averaged over 2006.
- 26 Data derived from: Cocoa Board of Papua New Guinea, Economics and Statistics Division 'Cocoa Statistics of Papua New Guinea, January 2006' (circulated report); 'Bougainville Cocoa Production Figures 2004/2005' single-page tabulation from Cocoa Board office Buka. Note this latter gives figures of export quality cocoa for 2004-05 of smallholder 15618, plantation 55, total 15673; this total is 1280 tonnes greater than in Cocoa Board's official tabulation but no reason can be provided for the discrepancy. Data for 2005/06 was derived from cocoa dealer's tonnage records provided to Cocoa Board Buka office or to IMPASS researchers.
- 27 UNDP Bougainville Rehabilitation, Reconstruction and Development Program Primary Sector Review Mission December 2000, p.12.
- 28 Based on Cocoa Board (Buka office) fermentary register records, December 2006.
- 29 See '*The Independent Cocoa Quality Survey 2006: Bougainville Region Report*', Department of Bougainville Division of Economic Services, which lists 110 dry bean buyers of which 68 were reported unlicensed. See also '*2004/2005 Registered Cocoa Exporters*' (bound A4 booklet), issued by Cocoa Board.
- 30 Smallholder cocoa production data from the pre-crisis period, when regulation problems (and data unreliability) were minor, can also be considered. However, this data (from ECL 1982) is old and does not reflect reported recent changes in district productivity, particularly that tonnages from south Bougainville have fallen by a factor of two to four from these pre-crisis levels. Estimates can also be based on assumed numbers of trees planted in each district (e.g. the estimates by Kondorr and Rahmann 1999). However, such data on the number of trees planted is at best speculative and yields based on these numbers tenuous. Finally, the number of households involved in cocoa production was tabulated by the 2000 census, but does not correlate at all to district production data. These alternative data sources were not used in the estimates.

- 31 Data from Cocoa Board tabulation for cocoa year 2004/05 is only broken down to cocoa district level: North 10,332 tonnes, Central 3,900 tonnes, South 1,441 tonnes, Total 15,673 tonnes. This however is a useful check on estimates of production share at cocoa district level.
- 32 Note that the ratings as presented in Bourke and Betitis (2003) are given value 1 for highest potential yield and 8 for lowest; whereas here, to utilize the ratings as multiplication factors, the ranking is reversed. Land units are based on Mapping Agricultural Systems Database GIS layer nsIndat.tab (16/06/1995): see Bourke et al 2002. Bleeker and Freyne 1981 produced an earlier mapping of land potential for cocoa in Bougainville.
- 33 Data sources: Data 1976-1989: Statistics Section, PNG Department of Agriculture and Livestock (1976-1989) via Bourke & Betitis 2003; Data 1990-2002: Kokonas Industri Koporesen (1990-2002), via Bourke & Betitis (2003); Production 2003-06 estimated from data provided by KIK in Feb. 2007 for 2003-06 and supplementary data from CPL Buka in March 2007 for 2004-06 and Makerio Stevedores Buka in March 2007 for 2005-06.
- 34 Quarterly figures are derived from (1) CPL bills of lading for shipments of break-bulk bagged cocoa and (2) Makerio Stevedores Buka files of 'Interim Receipts' and 'Outwards Container Lists' while probably somewhat incomplete show extra containerised shipments in 2005 by Pemana and in 2006 by COPM.
- 35 There is one known copra exporter in Arawa, whose exports according to another (Buka) exporter were 3000 tonnes in 2005 and 1000 tonnes to October 2006, but these casual estimates may not be reliable. Note too a report in *Solomon Star* 22/11/2004 that 'around 5,000 tonnes of copra produced on Bougainville has been exported illegally through Solomon Islands by illegal buyers on the island', and a quote from a KIK official saying all other buyers apart from CPL "were illegal". This would mean the Arawa dealer or dealers.
- 36 We recognise that in the established administrative geography of Bougainville, Arawa is part of 'Central District'. In this report, references to Arawa as part of the south are related to its present classification as south from an economic geographic point of view.
- 37 Using 2000 census figures: Total population excluding Nissan and Atolls = 167047; Bana, 14882; Siwai, 13724; Buin, 26469; Arawa, 31462.
- 38 Average monthly rainfall data from McAlpine, J.R., Keig, G., and Short, K., 1975. *Climatic Tables for Papua New Guinea*. CSIRO Division of Land Use Research Technical Paper No.37. More recent data is not available. Years of records on which chart is based: Sohano 11 years, Kieta 27 years, Buin coast 15 years.
- 39 Although not utilised in this report, a detailed study of agricultural anthropology in Buin has recently been completed by Joachim Lummani of CCI Kerevat (Lummani 2007).
- 40 Kondorr and Rahmann (1999) also refer in their introduction to 'the poor condition of the road network and acute shortage of transport availability' at the time of their survey across all districts in February-April 1999. Also Jane Lake (AusAID) *pers comm.*, notes that when BCTRRP started working on the trunk road, 'it was largely not passable, or not viably and reliably passable'.
- 41 AusAID funded a crushing and screening plant under the BCTRMP in 2002 which produced approximately 20,000 cubic metres of processed material suitable for road basecourse. (Bob Willis, *pers comm.* Oct 2007).
- 42 Counts were taken over two days mid-week. The method used was that described in the PNG Road Assessment Management System *Road Survey Manual* instructions. In brief, traffic was counted from both directions from 6am in the morning to 6pm evening. A tally sheet was used to mark the hour of day and the sizes of vehicles. Raw data results in tally sheet format are reproduced in the annexes.
- 43 Note that traffic counts presented in the Activity Completion Report for BCTRMP Exit Phase (draft document seen, November 2007) put a figure of 860 vehicles daily passing Hutjena on the Buka East Coast road. These figures are strongly at odds with the counts presented here.



- 44 Agmark Pacific local buyer agency data shows that cocoa was also sea freighted from Ramazon in April to May 2000, Tinputz from November 2000 to January 2001, Inus from October 2000 to July 2001 and Wakunai from April 2000 to June 2003 (and continues in small quantities to present).
- 45 Peter Tsiamalili, *pers comm.*, October 2006.
- 46 Data on mortality, education levels and incomes were not mapped, although there is potential to use for this the Census 2000 data and upcoming results of a socio-economic survey by the National Statistics Office later this year. Cautious use could also be made of a UNDP funded socio economic community survey undertaken in 2006.
- 47 In Wakunai district there has also been some movement of people back to the coastal (near-road) areas since the crisis, a movement made up of people from Wakunai who had fled the coastal areas for the hills in the crisis. This migration is not of the in-migration type examined here, but in discussion with locals is often introduced to the discussion although is not distinguished from in-migration.
- 48 Under Stabex FMO 1992/1994, which allocated K3.5m for mainland roads and Stabex FMO 1992/1993/1994, which allocated K1.75m for Buka island roads.
- 49 Torokina and Buka districts do make great use of tractors however, and Buin did in previous times, although with the poor economic state of Buin, their tractors are mostly laid up. Detractors of tractors in Tinputz and Wakunai counter that tractors are only fit for plantations and point to the short distances and flat terrain traversed by Torokina and Buka tractors.
- 50 See *Post Courier* 'New barrow wheels into B'ville' 05/11/2006. The Italian-made Grillo Dumper 507 power barrow donated to Tinputz RTC was still unassembled in the school workshop in late November 2006.
- 51 Where possible values were nominated for each item by the road contractors themselves as the price they paid (where equipment was purchased between 1999 and 2007). Where values were not given, a nominal value of either K20,000 or K50,000 was attributed to the item.
- 52 Much information about community road teams and fostering of community relations is contained in: *Project Completion Report, Bougainville Coastal Trunk Road Rehabilitation Project*, AusAID, May 2002; and *Activity Completion Report, Bougainville Coastal Trunk Road Maintenance Project*, Final Draft, AusAID, August 2006.
- 53 *Activity Completion Report, Bougainville Coastal Trunk Road Maintenance Project*, Final Draft, AusAID, August 2006.
- 54 *BCTRMP Exit Phase Activity Completion Report* (draft version October 2007).
- 55 By type of handling area, the capacity in 20ft containers for Buka wharf is: Vessel off/on handling 25, Goods packing/unpacking 100, Long term goods storage 45, Empty containers 60, Kokopau ferried goods transit 6. (Makerio Stevedores *pers comm.* Feb 2007).
- 56 Note that in shipping, deadweight tones is a measure of all cargo, crew, fuel and supplies onboard, measured in tonnes mass. Gross tons however is a completely unrelated measure of the ship's internal volume, absolutely nothing at all to do with tonnes mass. However in the case of shipping at Buka, all the 'Coast' ships are approximately the same gross tons, so are probably about the same deadweight tonnage: certainly none of them approach 7300 DWT in size.
- 57 Relevant details of vessel, arrival and departure dates and revenue tonnages by category were transcribed for slightly over 1500 invoices, which completely covered the period 01 January 2000 to about 10 September 2006. Transcription was done by the Project Director and local team members, data was entered to spreadsheet by a local typist and then extensively checked and corrected by the Project Director. In the Project Director's view, errors are likely to be few and insignificant.
- 58 Not all PCI 'outward agricultural' tonnage is annotated as copra, so that it is possible not all charges for copra shipments were tracked. This would account for at least some of the shortfall.

- 59 These values are chosen arbitrarily at a value that should be conservative but more realistic than the zero value that would be derived from the deficient data available. They are indicative only.
- 60 Makerio's stevedoring records, consisting of Outward Container Lists and Interim Receipts, are often not complete in detail, and may in some cases be entirely missing, as the records are bound loose leaf in ring binders, probably rapidly and under time pressure. Figures should be treated as approximate. Outspan's cocoa tonnage out is calculated from Outspan's own monthly shipment records for Jan-Nov 2006 (321.6 tonnes plus an estimate for December of 29.2 tonnes, which is simply the average of the preceding 11 month's production). Makerio data shows just 115 tonnes approximately for 2006 cocoa shipments by Outspan.
- 61 There are suggestions that the overbuilding stemmed from use of grossly exaggerated estimates instead of more realistic projections, in circumstances of inexperience and promotion by vested interests (Trevor Clarke *pers comm.* Sept. 2007).
- 62 BCCDRP data was retrieved in various formats. Phase 2 data was tabulated in the 'BCCDRP Final Completion Report' (Feb. 2006), although data for cocoa dryer repairs and copra dryer repairs was not tabulated. Phase 1 data was found in October 2006 as tabulations printed off and pinned to the old BCCDRP office wall in Buka, but was not located in any project report seen. This also yielded copra dryer repair data for phase 2. A spreadsheet containing individual project details was also obtained, but when sorted its tallies disagreed with the tabulated data noted above. Summary data of project achievements for phase 1 as presented in the 'Phase 2 Inception Report' (March 2004) and for phase 2 as presented in the 'Final Completion Report' (Feb. 2006) differed yet again. Much of the variation was probably due to the exact time data was compiled as each phase neared completion, while final projects were still being approved or distributed.
- 63 Total number of projects delivered (5,599) differs by 20 units from that in the table for total projects distributed by type (5,619); this is because district distribution required use of phase 2 cocoa dryer repair data that had details of only 73 projects rather than the 93 cocoa dryer repair projects recorded in the main tabulation.
- 64 '*Inception Report BCCDRP Phase 2*', May 2004.
- 65 Senate Foreign Affairs, Defence and Trade References Committee. Inquiry into Papua New Guinea and the Island States of the South-West Pacific. Submission No. 33, Dept. Foreign Affairs and Trade, 5 July 2002.
- 66 UNDFW 2004, "Getting it Right, Doing it Right: Gender and Disarmament, Demobilization and Reintegration" United Nations Development Fund for Women, October 2004 (online at [www.womenwarpeace.org](http://www.womenwarpeace.org)).
- 67 Annual Report 2001. A number of the objectives of the BCCRP overlapped significantly with AusAID's own BCCDRP. BCCRP's seven objectives were: replanting of all trees lost during the crisis, rehabilitation of all existing cocoa and coconut planting, restoration of all copra and cocoa processing facilities, increase the knowledge and skills capacity of growers, improve quality of all cocoa and copra produced, foster effective marketing and value adding to all export cocoa and coconut products.
- 68 'Bougainville Rehabilitation Reconstruction and Development Project Report of the Assessment Mission (Primary Sector) June 1999' PNG/98/002/07/UNOPS, UN Office for Project Services; 'Project Annual Report December 2002' (Bougainville Cocoa Coconut Rehabilitation Project). PNG Cocoa and Coconut Institute, Industry Services Division. Note that EU referred to the project as the "Community Cocoa Cropping" project, EU.15.04.02B.
- 69 AusAID 'Seedling Distribution Project' funding. See 'Bougainville Cocoa Coconut Rehabilitation Project UNDP PNG/98/002/007, Annual Report 2001' 16 January 2002; 'Bougainville Cocoa Coconut Rehabilitation Project UNDP PNG/98/002/007 / Community Cocoa Cropping EU.15.04.02B / Cost-share Partnership, Progress Report, 1<sup>st</sup> January-30<sup>th</sup> September 2001'.

- 70 Two sources quoting overall figures however are: ABG Division of Economic Services ‘*Annual Report 2005*’, citing 10,277,194 hybrid cocoa seedlings distributed from April 1998 to December 2005; ‘*Bougainville Provincial and District Profiles and the Proposed Cocoa Targets*’, Cocoa Board PNG November 2005 citing CCI records ‘a total of 12,513,935 seeds and seedlings distributed to growers since 2000’.
- 71 Data sources: (1) and (4): BCCRP Progress Report 01 January - 30 September 2001. UNDP: PNG/98/002/007; (2) and (5): Project Annual Report December 2002 (BCCRP); (3) and (6): BCCRDP Final Report Interim Phase 1 Apr 2004 to 31 Mar 2005.
- 72 Drawn from *BCCDRP Independent Completion Report*, April 2006 (Andrew McGregor). The ICR provided these notes on the forecast: “Demand for cocoa processing facilities remains high”: This demand is expected to increase significantly over the next few years. With hybrid cocoa plantings that have occurred over the last 5 years peak demand for drying capacity will be reached around 2010/11, with production expected to reach around 21,000 tonnes This could be potentially as high as 27, 000 tonnes and possibly as low as 16,000 tonnes. The ICR’s production forecasts are presented in figure 1, based on the 15 million hybrid seeds and seedlings distributed since 1998. The actual achievement will depend on the rate of adoption of the improved husbandry techniques being promoted by CCI. More accurate forecasts will be feasible after the completion of a survey to be conducted by CCI. There are plans to distribute a further 5 million seedlings. These additional seedlings have not been factored into the forecasts.”
- 73 Trevor Clarke notes that black pod can wipe out 80% of a crop (*pers comm.* Sept. 2007); note too that cocoa pod borer *Conopomorpha cramerella* which is established in East New Britain and will sometime reach Bougainville can reduce yield by 20-50% (Andrew McGregor *pers comm.* Sept. 2007).
- 74 The chart is generated from the data in Table 17 for BCCDRP projects by district, and the reported total households per district from 2000 census data. In the chart, the 53 copra dyers repaired under BCCDRP are for convenience included in with the 2,842 trust fund projects delivered.
- 75 *Post Courier* 05/10/2005 ‘Ban on Mini Dryers’, *Post Courier* 16/11/2005 ‘Cocoa quality on debate’.
- 76 John Nightingale, Managing Director, Agmark Pacific, *pers. comm.*, March 2007. Ian Kershaw *pers comm.* Sept 2007.
- 77 Hollywood, N.W., and Toreu, B., 1998. *CCRI report on minibox and solar dryer on farm adaptive trials in east new Britain province, July 1998*. (Unpublished, CCRI Kerevat ENB); Omuru, E., 1997. *Economic Benefits of adopting Miniboxes and Solar Driers in the cocoa smallholder sector in Papua New Guinea*. Economics Section Discussion Paper No.4., PNG Cocoa and Coconut Research Institute, Kerevat.
- 78 ‘*Bougainville Cocoa and Copra Drier Rehabilitation Project Feasibility Study Report and Project Design Document*’ Final Draft, AusAID, June 2000.
- 79 Omuru, E., 1997. *Economic Benefits of adopting Miniboxes and Solar Driers in the cocoa smallholder sector in Papua New Guinea*. Economics Section Discussion Paper No.4., PNG Cocoa and Coconut Research Institute, Kerevat.
- 80 Note that the reason that owners would replace a dryer rather than always simply building a new one beside, is that every fermentary must be registered, with a licence fee paid annually.
- 81 *BCCDRP Independent Completion Report*, April 2006, notes: ‘A doubling of drying capacity will be required to meet the increase in cocoa production over the next six to seven years. Component replacement of existing dryer s will also be required. Under normal use the flue pipes being used will need to be replaced after around 2 years and the chimney after 18 months’.
- 82 ‘*BCCDRP Final Activity Completion Report*’, Feb 2006.
- 83 Early in BCCDRP, demand for vanilla cuttings was high when prices topped US\$800/kg as a result of crop failure in the main supplier country Madagascar. At that time in PNG, even second grade vanilla could be sold. Agmark, the largest vanilla exporter, exported 300 tonnes

in 2003. World production has since picked up, and in PNG only high quality vanilla now has a market (Agmark purchased 6 tonnes of high quality vanilla in 2006). High quality vanilla gives growers a reasonable return, however at present growers do not have information on how to grow and cure high quality vanilla. Due to BCCDRP, Bougainville has a large supply of planting material now in place, and this is potentially productive if either growers learn how to produce high quality vanilla or else the world market again booms as it did in the early 2000s, accepting second grade vanilla. This however must be qualified in that higher rainfall areas (e.g. southern Bougainville) are unsuited to vanilla flowering. Vanilla is still a viable crop where correct agro-ecological conditions exist and the required quality standards are achieved. (Andrew McGregor *pers comm.* 2007, Trevor Clarke, *pers comm.* 2007).

84 Free-roaming pigs are a nuisance however as foraging pigs destroy food gardens. Pig fencing materials were popular due to the need to fence pigs in as a tool in food garden management. In this respect, fencing supplied by BCCDRP will last for many years and has been successful for food security (Trevor Clarke, *pers comm.* 2007). However, captive pigs still need to be fed garden crops so it is not a matter of problem solved but problem managed.

85 Trevor Clarke, the BCCDRP Project Coordinator, has provided further useful comments on this matter: ‘... to say we did not plan [chicken delivery] is not the case, because generally the chickens and feed got to their destinations. The logistics of delivery of the chickens and feed, when it depended on air, sea and road transport to often remote areas, and someone to supervise to make sure chickens didn’t die and feed arrived took up quite a lot of time of staff which in retrospect might have been better used elsewhere. The main problem was the sustainability i.e. families would often get on batch of chickens and raise them and either eat them or give them to friends and relatives and then they would find it hard to gather the money to reorder, and find someone to do the reordering, though there were private companies engaged in this they were in the centres, i.e. Arawa, and Buka. In future projects, improvement of local chickens and introduction of village hardy types should take priority over introduced poultry requiring special feed.’ (*pers comm.* 2007).

86 On this point, the Independent Completion Report for BCCDRP (April 2006) noted that for “enterprise areas such as poultry and vanilla the level of training and technical assistance was inadequate. It probably would have been preferable to have had fewer trust fund projects, with the savings allocated to training and follow-up support”.

87 Phase I data extracted from table in ‘BCCDRP Phase II Project Design’, March 2004. Phase II data is from BCCDRP project database spreadsheet. The BCCDRP Final Completion Report reported a total of 272,890 seedlings distributed, close to the spreadsheet tally of 271,590. The discrepancy is either due to incompleteness of the spreadsheet or that the Final Completion Report used updated figures.

88 BCCDRP Final Activity Completion Report’, February 2006. Other scattered comments included ‘Interest in tree seedlings was for income generation and building materials more than for firewood replacement. This shows that the farmers generally don’t see firewood to be a big problem for the process of drying cocoa and copra’, and ‘Trees for firewood not considered a priority among many cocoa farmers’.

89 Trevor Clarke, ex-Project Coordinator for BCCDRP argues that there are more plantation-type plantings in central and southern Bougainville than Forestry are aware of (*pers comm.*).

90 ‘Provincial Forest Plan for Bougainville 2003-06’ ABG, July 2003.

91 Note that crop production figures are for 2006 and population estimates are for 2007. Although it would be more desirable to use population estimates for 2006 (which would involve subtracting 2.5% from the 2007 figure), it was decided to simply use the 2007 population figures presented in the map in Figure 1. The error is marginal, well within the probable error involved in deriving the crop production estimates.

92 That traditional economy is the more fundamental to social wellbeing in comparison to the cash economy is a central tenet of Me’ekamui and other traditionalist movements in Bougainville

and elsewhere in Melanesia, and is a common trope of Melanesian discourse. For many Bougainvilleans, the beginnings of the crisis at the heart of the world's erstwhile richest copper mine, Panguna, only proves the point.

93 This conclusion, based on discussion in section 3.4.3, has drawn criticism on the following grounds: 1. Emphasis on mini dryers and rehabilitated small dryers was at the core of success of BCCDRP; they increased competition without negative impact on cocoa quality. 2. Mini dryer size was appropriate because they were relatively easy to manufacture in numbers by inexperienced manufacturers and could be distributed where roads were rudimentary. 3. If dryers were bigger, fewer could have been distributed, smaller block holders would probably not have been able to come up with the equity required and so missed out. This would especially have been the case for women and disadvantaged who were being targeted with the dryers. 4. Widespread emancipation of smallholders from the old pre-crisis oligopolistic arrangements. 5. Structurally, small dryers avoid the oligopolistic tendencies developed with large dryer use, or the mismanagement of centralised cooperative society arrangements. 6. Mini and small dryers have reduced the environmental burden of cocoa processing (use of garden softwoods in small dryers rather than forest hardwoods in large dryers). These are all valid points and doubtless the BCCDRP was right to favour the smallholder sector and supply, in general terms, smaller dryers. However the basic fact that demand on the dryers exceeds their capacity still suggests that areas with higher yield need more dryers and/or dryers at the larger end of what could still be classed as small dryers (i.e. up to 150 sq.ft.).

94 Trevor Clarke, ex-Project Coordinator for BCCDRP, disputes that BCCDRP mistook farming practices with regard to firewood trees: 'The clearing of large forested areas for food gardens and tree crops continues and will increase in scale as the population increases. The concept that farmers would manage trees on the boundaries of their gardens and tree crops is not a bad concept to introduce even though it may be foreign to many of them. The lack of assistance from NFO forestry and DPI staff in training farmers on the need for trees and maintaining them has meant this intervention was largely a failure; however, there are some pretty successful plantation tree plantings that BCCDRP can take some credit for.' (*pers comm.* 2007).

95 Cost data for this study were provided by AusAID. All dollar values are Australian dollars. Road maintenance funding for 2005/06 and beyond has not been included, for which see discussion in section 4.3.

96 This graph is reproduced from Sugden 2003:14

97 The relevant figures from the survey were: 8.7 million trees were fruit bearing in 1999, about 2.2 million trees were maturing and 5.2 million had been damaged by the 1997 drought (Kondorr and Rahmann 1999).

98 The world price of cocoa doubled from around US\$1,100 per tonne of cocoa in 2001 to nearly US\$2,200 in 2002 (ICCO statistics). Sugden (2003) reports that this, in conjunction with the continued depreciation of the Kina meant that the delivered in-store price rose from K3,000 per tonne in 2001 to an average of K6,200 per tonne in 2002.

99 ICCO statistics, Sugden 2003.

100 The actual 'bounce' in production seen in 2001/02 does not affect the view taken on the counterfactual. It is clear that year-on-year supply responses to price signals may vary over the course of the period covered by the counterfactual – however, on average, an annual growth rate of 7.5 percent appears compatible with the evidence on Bougainville's capacity to increase production in the absence of the aid projects.

101 BCCDRP Independent Completion Report (6 April 2006).

102 Assumptions about output growth imply that the 'with-aid' and 'without-aid' series converge by around 2022. The benefits are therefore counted from the baseline year of 2000 up until 2022 – a total of 23 years. Speculation about the slope of the respective curves ends at 2022.

103 Bougainville therefore accounts for less than 0.5 percent of global output.

- 104 Conversation with John Nightingale, Managing Director, Agmark, during March 2007 field trip reported by Ian Scales.
- 105 Robert Bolling of New Guinea Plantations, transcript, Commission Of Inquiry Into the National Provident Fund: ‘We were selling a lot of cocoa to Rowntrees on a contract basis for seventy pounds sterling over the market price, because of the premium quality we were producing’. [www.pm.gov.pg/pmsoffice/pmsoffice.nsf/pages/F126E3F4442BB4264A256C3D002DCACA?OpenDocument](http://www.pm.gov.pg/pmsoffice/pmsoffice.nsf/pages/F126E3F4442BB4264A256C3D002DCACA?OpenDocument)
- 106 If governments raise general tax revenue from exports then this need not be ‘netted out’ from the benefits estimate, because these benefits flow to the populace in the form of other government services.
- 107 Proceeds from this levy were used to help pay back a loan taken from the EU in the 1990s to support farmers when cocoa prices were at a historical low. A sizeable portion of that loan has recently been written off. The precise contribution of the stabilisation levy for paying back the loan cannot be ascertained with any degree of accuracy, and for this reason this levy is not deducted from the benefits estimate.
- 108 BCCDRP Draft Activity Completion Report, p.5.
- 109 Different assumptions about future cocoa prices result in changes that are *proportionate* to the assumption about the increase or decrease in prices.
- 110 Estimate of doubling based on comments by Mr Simon Barananko, a PMV operator.
- 111 With peace and road rehabilitation, demand would have increased at all price levels (i.e., the entire demand schedule shifts from D to D’); a similar outward shift would have occurred for the supply schedule. On balance, this would leave the typical fare unchanged (P\* remaining the same). The change in consumer surplus, i.e., the additional area above the prevailing market price and under the demand curve is shown as the shaded area in Figure 41. The change in ‘producer surplus’ – the area above the supply curve but below the prevailing market price – has not been indicated in Figure 41, as consideration of producer surplus from this CBA, has been excluded.
- 112 Mr Albert Kinane, CEO of the Bougainville Engineering Contracts Group, and Head of Division of Economic Services (focusing on agriculture), Department of Economic Services.
- 113 Mr Peter Kelly, Infrastructure Adviser AusAID, *pers comm.* 29 January 2007.
- 114 Mr Peter Kelly, *pers comm.*
- 115 A similar multiplier is recommended in Australia by the ACT Treasury. The ACT has some similarities to an island economy in that it imports many products and consequently has a much larger share of ‘leakage’ than other Australian states.
- 116 According to the PDD, the rationale for the individual project components was as follows: 1) Buka: there was only one operational wharf 32 m in length, inadequate for present shipping. Only one ship could load and unload cargo at a time (done by ship cranes loading via slings); other ships would sometimes be berthed in parallel, waiting. Handling of goods was inefficient and demurrage (storage on the wharf, which is charged for) was prolonged. As discussed earlier, cocoa exports do not go through this wharf which is used for general shipping (imports of fuel and items for sale in retail stores, etc.). 2) Kangu: road transport to the Kieta wharf was difficult because of the very poor condition of the road and disputes (although “local people can use the roads...”). The distance to Kieta added to costs. The alternative of taking cocoa and copra by small boat to meet coastal traders moored in deep water was laborious and had a spoilage rate of up to 40 percent. The shed at the wharf is to minimise delays in loading ships. 3) Siwai district shed: the infrequent shipping service means that harvesting is lower than it could be in order to avoid spoilage. Farmers are paid only when their produce is delivered to the warehouses. “If farmers in the Siwai district had a central storage facility... where they could sell their cocoa and copra and get paid, then their intermediate transport problems would be solved.”



- 117 Although Buka is a consolidation and transshipment point, ships sometimes proceed direct from other Bougainville ports to Rabaul, the ultimate point of transshipment (to larger ships heading overseas).
- 118 The Project Design Document for the Bougainville Wharves Rehabilitation Project (September 2000) states that: “The poor access by those routes [road routes from Telei and Siwai districts to the wharf at Kieta] is evidenced by the fact that villagers prefer to export their crops by sea from Mamagota and Kangu Beach. The method used at present is to load bags of cocoa and copra into small boats and take them out to sea to meet coastal traders moored in deep water (in the case of Mamagota there is a two-stage process because the bags first have to be taken across the river in boats and then taken from the beach to the boat in other boats). The process is slow and uncertain. There is a spoilage of 40% of the cargo during the transport process. Even allowing for the spoilage, the present method will not be feasible to transport the projected exports that will be produced in the next one to three years.”
- 119 The strengths and weaknesses of micro-credit schemes have been widely debated (see, for example, Roth 1997, Horan 2002 and European Commission 2003). The European Commission (2003) report shows that 5-year survival rates for micro-credit businesses were as low as 40% in the EU (figures for the UK and Denmark) suggesting an overall indifferent performance of micro-credit projects.
- 120 *BCCDRP Independent Completion Report* by Andrew McGregor for AusAID, April 2006.
- 121 To prevent this, AusAID may commit further funds to road maintenance in Bougainville in the future (although the extent to which such financing will be forthcoming cannot be speculated upon).
- 122 Michael Tomun, seconded from PNG government to ABG.
- 123 Bougainville Peace Agreement (30 August 2001) article “Agreed principles on Referendum” states that “the choices available will include a separate independence for Bougainville”, the outcome of the referendum subject to the final decision by the PNG National Parliament, and the referendum to be held 10 to 15 years after the election of the first Autonomous Bougainville Government (which occurred on 15 August 2005).

# 8 Annexes

## 8.1 Population statistics, estimated for 2007

Derived from Census 2000 data, compounded at 2.5% per year.

LLG NAME	POP 2000	POP 2007	HiHOLDS 2000	HiHOLDS 2007
BUKA	36,676	43,600	5,483	6,500
SELAU	9,446	11,200	1,682	2,000
TINPUTZ	9,767	11,600	1,606	1,900
WAKUNAI	10,023	11,900	1,860	2,200
ARAWA	31,462	37,400	5,868	7,000
BUIN	26,469	31,500	4,686	5,600
SIWAI	13,724	16,300	2,761	3,300
BANA	14,882	17,700	2,817	3,300
TOROKINA	5,509	6,500	1,060	1,300
KUNUA	9,089	10,800	1,692	2,000
NISSAN	2,388	2,800	887	1,100
ATOLLS	5,725	6,800	561	700
<b>TOTAL</b>	<b>175,160</b>	<b>208,100</b>	<b>30,963</b>	<b>36,900</b>

## 8.2 Estimate of cocoa potential

An estimate of potential share of cocoa yield for each LLG district is derived from the original Hanson *et al* ratings by assuming the ratings relate to a linear ratio of yield possible from each land unit, a 'factor of yield'  $K^n$  (where 'n' is a power that modifies the value of  $K$ ). The results are given as an overall index of LLG district potential,  $G$ . For each LLG district,  $G = (A_7 * K_7^n) + (A_6 * K_6^n) \dots + (A_1 * K_1^n)$ .

The table below provides a summary of the results of such an analysis for one possible factor of yield. The table shows the area of land classified under each suitability ranking, and an estimate of the proportion of potential yield for each LLG district. Even with different values of  $n$ , the share of yield potentially produced by each district do not nearly resemble the shares of actual production, either for the period c. 2004-06 or 1978-80.

**Table 26. Estimated potential cocoa production share by LLG district.**

Rating of potential yield, 'K'	7	6	5	4	3	2	1	0	Index of potential yield, G, from	Index G as %
Factor $K^n$ where $n = 2$	49.0	36.0	25.0	16.0	9.0	4.0	1.0	0.0		
Land area										
LLG DISTRICT	(km <sup>2</sup> )	AREA UNDER EACH VALUE OF K (km <sup>2</sup> )							value of $K^n$	share
BUKA	615	0	0	0	470	3	108	0	34	7,981 6.9
SELAU/SUIR	445	20	104	50	0	66	77	0	128	6,887 6.0
TINPUTZ	633	26	89	34	2	0	110	0	372	5,798 5.0
WAKUNAI	1164	0	585	0	35	0	66	0	478	21,868 19.0
ARAWA	1854	0	174	0	0	16	592	227	845	9,012 7.8
BUIN	1446	0	0	506	344	0	24	242	331	18,485 16.0
SIWAI	735	0	0	244	286	27	0	3	176	10,906 9.5
BANA	463	0	0	53	301	0	0	52	56	6,198 5.4
TOROKINA	975	0	218	40	57	28	94	62	476	10,462 9.1
KUNUA	1057	0	456	0	33	4	191	13	360	17,760 15.4
<b>TOTAL</b>	<b>9387.0</b>	<b>46</b>	<b>1,626</b>	<b>927</b>	<b>1,527</b>	<b>145</b>	<b>1,262</b>	<b>599</b>	<b>3,255</b>	<b>115,358 100.0</b>

For each LLG district,  $G = (A_7 * K_7^n) + (A_6 * K_6^n) \dots + (A_1 * K_1^n)$ .

## 8.3 Road traffic count data

### 1. Lonahan junction

#### 1.1 Road to Gagan, Day 1, Wednesday 13/12/06

Hours	6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	TL
Cars, Station wagons, Sedans	-	6	-	-	11	12	-	-	-	-	-	-	6
Utes/Pickups & Small PMVs	-	3	4	3	-	1	-	-	-	-	3	6	20
Buses & Large PMVs	9	5	4	6	3	4	-	1	6	4	3	6	51
Light Trucks (2 Axles)	-	-	-	-	-	-	-	-	-	-	-	-	0
Medium Trucks (3 Axles)	-	-	-	-	-	-	-	-	-	-	-	-	0
Total	9	14	8	9	3	5	0	1	6	4	6	12	77

#### 1.2 Road to Gagan, Day 2, Friday 15/12/06

Hours	6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	TL
Cars, Station wagons, Sedans	-	-	-	-	11	12	-	-	-	2	-	-	3
Utes/Pickups & Small PMVs	-	3	1	-	-	-	1	1	-	-	2	1	9
Buses & Large PMVs	9	10	3	4	3	4	2	2	8	4	8	13	70
Light Trucks (2 Axles)	-	-	-	-	-	-	-	-	-	-	-	-	0
Medium Trucks (3 Axles)	-	-	-	-	-	-	-	2	-	-	-	-	2
Total	9	13	4	4	3	4	4	5	8	6	10	14	84

#### 1.3 Road to Gogohe, Day 1, Wednesday 13/12/06

Hours	6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	TL
Cars, Station wagons, Sedans	-	2	2	1	-	3	2	-	3	-	1	2	13
Utes/Pickups & Small PMVs	-	8	5	2	1	3	5	1	1	-	5	8	39
Buses & Large PMVs	-	23	16	8	5	6	5	1	11	15	15	6	111
Light Trucks (2 axles)	-	-	-	-	-	-	-	-	-	-	-	-	0
Total	0	33	23	11	6	9	12	2	15	15	21	16	163

#### 1.4 Road to Gogohe, Day 2, Friday 15/12/06

Hours	6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	TL
Cars, Station wagons, Sedans	-	-	-	2	11	12	-	-	-	5	2	4	13
Utes/Pickups & Small PMVs	4	7	10	4	-	4	2	-	3	4	5	6	49
Buses & Large PMVs	11	23	15	14	11	9	9	7	16	17	17	9	158
Light Trucks (2 Axles)	-	-	-	-	-	-	-	-	-	-	-	-	0
Medium Trucks (3 Axles)	-	-	-	-	-	-	-	-	-	-	-	-	0
Total	15	30	25	20	11	13	11	7	19	26	24	19	220

### 2. Itakara (Morgan) Junction

#### 2.1 Road to Buka, Day 1, Wednesday 15/11/06 (Note: Buka-bound PMV traffic begins approx 3:30am, this early traffic not counted)

Hours	6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	TL
Cars, Station wagons, Sedans	-	-	-	-	11	12	-	-	-	-	1	-	1
Utes/Pickups & Small PMVs	20	7	5	-	-	-	3	9	5	-	6	6	61
Buses & Large PMVs	-	-	-	-	-	-	-	-	-	-	-	-	0
Light Trucks (2 Axles)	-	-	1	2	1	-	-	-	4	-	-	1	9
Medium Trucks (3 Axles)	-	-	1	-	-	-	-	-	-	1	-	-	2
Total	20	7	7	2	1	0	3	9	9	1	7	7	73

#### 2.2 Road to Buka, Day 2, Thursday 16/11/06 (Note: Buka-bound PMV traffic begins approx 3:30am, this early traffic not counted)

Hours	6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	TL
Cars, Station wagons, Sedans	-	-	-	-	11	12	1	-	-	-	-	-	2
Utes/Pickups & Small PMVs	7	15	3	2	1	1	3	5	7	3	13	5	65
Buses & Large PMVs	-	-	-	-	-	-	-	-	-	-	-	-	0
Light Trucks (2 Axles)	1	-	1	-	1	-	-	-	1	2	-	-	6
Medium Trucks (3 Axles)	-	-	-	-	-	-	-	-	1	1	-	1	3
Total	8	15	4	2	2	2	4	5	9	6	13	6	76

### 2.3 Road to Bana, Day 1, Wednesday 15/11/06

Hours	6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	TL
Cars, Station wagons, Sedans	-	-	-	-	11	12	1	-	-	-	1	-	3
Utes/Pickups & Small PMVs	-	-	-	-	-	14	7	10	8	6	11	7	63
Buses & Large PMVs	-	-	-	-	-	-	-	-	-	-	-	-	0
Light Trucks	-	-	-	-	-	1	2	1	-	-	-	1	5
Medium Trucks	-	-	-	-	-	-	-	-	1	-	-	-	2
Total	0	0	0	0	0	17	10	11	9	6	12	8	73

### 2.4 Road to Bana, Day 2, Thursday 16/11/06

Hours	6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	TL
Cars, Station wagons, Sedans	1	-	-	-	11	12	-	-	-	-	2	1	5
Utes/Pickups & Small PMVs	6	5	6	7	3	2	6	5	5	5	10	8	68
Buses & Large PMVs	-	-	-	-	-	-	-	-	-	-	-	-	0
Light Trucks	1	-	-	-	-	2	-	3	3	-	4	1	14
Medium Trucks	-	-	-	-	-	-	-	-	-	-	-	1	1
Total	8	5	6	7	4	4	6	8	8	5	16	11	88

## 3. Siara Junction

### 3.1 Road to Kunua, Day 1, 00/12/06

Hours	6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	TL
Cars, Station wagons, Sedans	-	-	-	-	11	12	-	-	-	-	-	-	0
Utes/Pickups & Small PMVs	-	1	2	-	2	-	-	-	-	2	2	-	9
Buses & Large PMVs	1	1	2	2	-	-	1	1	2	-	4	4	18
Light Trucks	-	-	-	-	-	-	-	-	-	-	-	-	0
Medium Trucks	-	-	-	-	-	-	-	-	-	-	-	-	0
Total	1	2	4	2	2	0	1	1	2	2	6	4	27

### 3.2 Road to Kunua, Day 2, 00/12/06

Hours	6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	TL
Cars, Station wagons, Sedans	-	-	1	-	11	12	-	-	-	-	-	-	1
Utes/Pickups & Small PMVs	-	1	3	2	1	1	1	2	-	1	3	2	17
Buses & Large PMVs	2	2	6	-	-	1	-	-	3	1	5	-	20
Light Trucks	-	-	-	-	-	-	-	-	-	-	-	-	0
Medium Trucks	-	1	-	-	1	-	2	-	-	1	-	-	5
Total	2	4	10	2	2	2	3	2	3	3	8	2	43

### 3.3 Road to Arawa, Day 1, 00/12/06

Hours	6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	TL
Cars, Station wagons, Sedans	2	-	-	-	11	12	-	-	-	1	-	-	3
Utes/Pickups & Small PMVs	8	20	15	11	11	10	14	18	9	10	9	6	141
Buses & Large PMVs	-	4	5	4	5	1	1	6	7	5	8	-	46
Light Trucks	-	-	-	2	2	-	-	-	2	-	-	-	7
Medium Trucks	-	-	-	-	-	-	-	-	-	-	-	-	0
Total	10	24	21	17	18	11	15	24	18	16	17	6	197

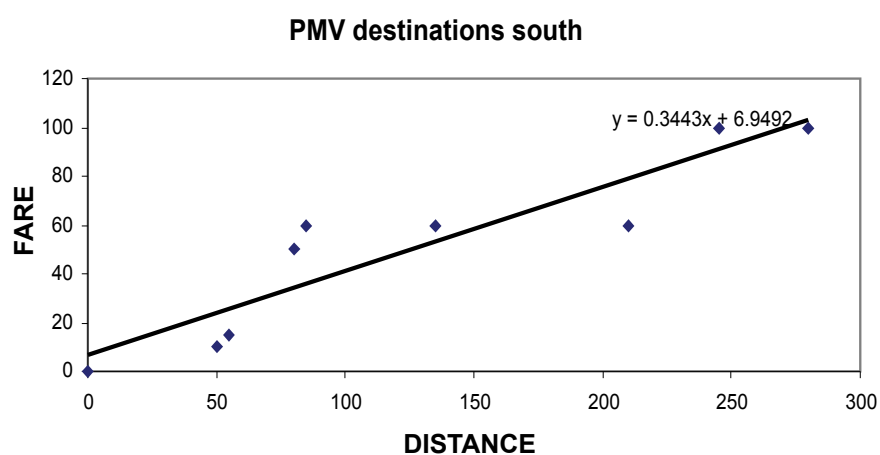
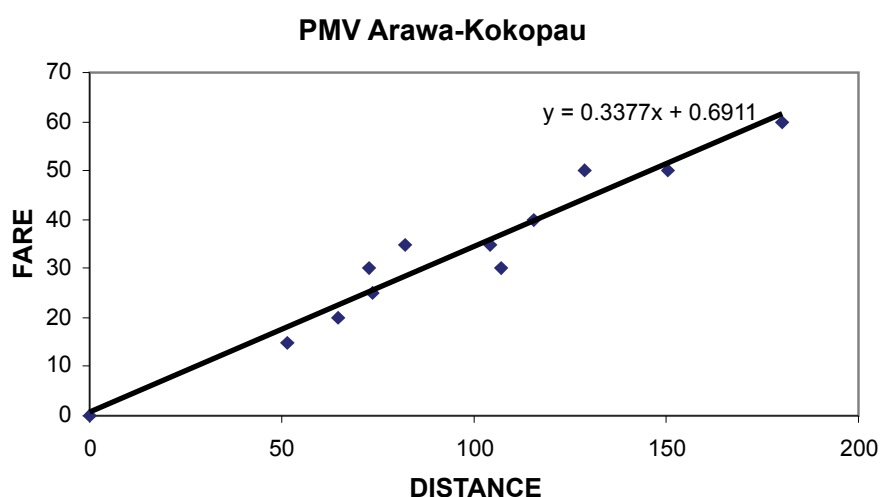
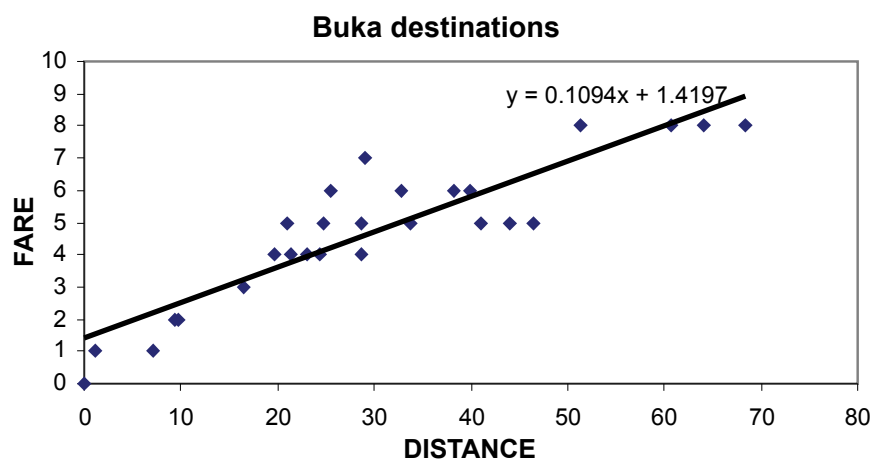
### 3.4 Road to Arawa, Day 2, 00/12/06

Hours	6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	TL
Cars, Station wagons, Sedans	-	-	1	-	11	12	-	-	-	-	1	-	2
Utes/Pickups & Small PMVs	5	20	20	20	9	12	11	22	14	10	8	8	159
Buses & Large PMVs	-	4	3	6	1	-	1	6	3	7	2	3	36
Light Trucks	-	-	1	2	-	-	-	-	-	2	1	-	6
Medium Trucks	-	-	-	-	-	-	-	-	-	-	-	-	1
Total	5	24	26	28	10	12	12	28	17	19	12	11	204

## 8.4 PMV fare trendline graphs

Derived from survey of PMV fares, December 2006

PMV fare trendline graphs, December 2006



## 8.5 Dryer/Fermentary capacity estimates

Derived from Cocoa Board fermentary register 2007/07 and BCCDRP data

	Nr. of registered mini dryers	Registered mini-dryer mesh area (ft2)	Mean registered mini-dryer mesh area (ft2)	Nr. of registered other dryers	Registered other dryers mesh area (ft2)	Mean registered other dryers mesh area (ft2)	Nr of BCCDRP mini-dryers distributed	Nr of BCCDRP other dryers rehabilitated	Nr. of non-registered mini-dryers	Nr. of non-registered other dryers	Est. total mesh area non-reg. mini dryers (ft2)	Est. total mesh area non-reg. other dryers (ft2)	area all mini-dryers mesh (ft2)	Estimated total mesh area all other dryers (ft2)	Estimated total mesh area all dryers in district (ft2)	Estimated total nr. of dryers in district	Estimated average dryer area in district (ft2)	Estimated cocoa production 2006 (tonnes)	Dryer yield in district (tonnes/dryer)	Dryer yield (tonnes/dryer)	Share of mesh that is mini dryers (5)	Very approximate yield for mini-dryers (tonnes)	Very approximate yield per mini dryer (tonnes)
Buka	92	4,416	48	88	15,101	172	106	137	14	49	672	8,409	5,088	23,510	28,598	243	118	1,050	0.0367	4.3	17.8	187	1.8
Selau/Suir	136	6,528	48	120	21,630	180	116	187	0	67	0	12,077	6,528	33,707	40,235	323	125	1,950	0.0485	6.0	16.2	316	2.7
Tinpuiz	124	5,952	48	193	31,336	162	217	151	93	0	4,464	0	10,416	31,336	41,752	410	102	3,750	0.0898	9.1	24.9	936	4.3
Wakunai	51	2,448	48	86	17,468	203	161	169	110	83	5,280	16,859	7,728	34,327	42,055	330	127	3,000	0.0713	9.1	18.4	551	3.4
Arawa	78	3,744	48	87	17,142	197	220	191	142	104	6,816	20,492	10,560	37,634	48,194	411	117	2,250	0.0467	5.5	21.9	493	2.2
Buin	36	1,728	48	137	37,533	274	349	102	313	0	15,024	0	16,752	37,533	54,285	486	112	750	0.0138	1.5	30.9	231	0.7
Siwai	8	384	48	6	1,712	285	87	121	79	115	3,792	32,813	4,176	34,525	38,701	208	186	450	0.0116	2.2	10.8	49	0.6
Bana	63	3,024	48	62	12,752	206	84	114	21	52	1,008	10,695	4,032	23,447	27,479	198	139	450	0.0164	2.3	14.7	66	0.8
Torokina	17	816	48	12	2,819	235	11	49	0	37	0	8,692	816	11,511	12,327	66	187	300	0.0243	4.5	6.6	20	1.8
Kunua	70	3,360	48	74	13,999	189	90	89	20	15	960	2,838	4,320	16,837	21,157	179	118	1,050	0.0496	5.9	20.4	214	2.4
Nissan	1	48	48	1	96	96	0	6	0	5	0	480	48	576	624	7	89	0	0.0000	0.0	7.7	0	-
<b>Total</b>	<b>676</b>	<b>32,448</b>	<b>48</b>	<b>866</b>	<b>171,588</b>	<b>198</b>	<b>1,441</b>	<b>1,316</b>	<b>792</b>	<b>527</b>	<b>38,016</b>	<b>104,419</b>	<b>70,464</b>	<b>284,942</b>	<b>355,406</b>	<b>2,861</b>	<b>124</b>	<b>15,000</b>	<b>0.0422</b>	<b>5.2</b>	<b>19.8</b>	<b>2974</b>	<b>2.1</b>



## 8.6 Mapping tabulations

The study accessed official GIS data including the PNGRIS database (2000-2001), PNG National roads data (July 2001) and Census 2000 Prov20 census unit MapInfo data (2002). Additional data was sought for locations of education and health facilities, and on road infrastructure. Data for these topics was out of date; the study had to construct new data sets, which are tabulated below.

In general the location of health and education facilities could not be done with high accuracy since the study was not able to take GPS readings at each site. Instead locations were derived by checking Census 2000 mapping, the Joint Operations Graphic 1:250,000 map sheets (RASC 1980), the Royal Australian Survey Corps 1:50,000 topo maps from the 1970s, 1980 census enumeration mapping (NSO 1982), and finally a check with informants either at the LLG district centre or officials in Buka familiar with the facilities in question. For primary schools additional help was derived from the Catholic Education Board's own 1:50,000 mapping of their school locations. Although the final result is thought a very good approximation, facilities in remote areas may not be accurately located. For roads, GPS readings when travelling and also data from the 1:50,000 wall map in the Road Consult office (Buka) was utilised. GPS readings and map projections were based on Australian Geodetic Datum 1982, Australian Map Grid Zone 56, to coincide with a geo-registered scanned version of the JOG 1:25,000 maps, which were used as the main underlay during mapping of features in Bougainville.

### *Health Centres*

Table BVLLE HEALTH CENTRES 2005 AGD84. Projection: AGD84 AMG Zone56. Facility names, total number of outpatients and percent of supplies short were derived from Div. Health, Health Information Office (Sohano), database output: 'North Solomons Province General (YTD) report January to December 2005'. 32 records.

HEALTH_CTR	TYPE	NR_OUTPTNTS	SUPPLIES_SHORT_%	LON	LAT
Arawa HC	HC	13508	11.8	783,923	9,311,036
Boku HC	HC	4757	3.3	760,562	9,273,226
Buin HC	HC	8984	8.9	797,339	9,253,090
Buka UC	UC	0	24.7	685,627	9,400,235
Buka Hospital		25666	0.0	685,627	9,400,235
Gagan SC	SC	9389	12.0	679,527	9,420,961
Hanahan SC	SC	6981	0.8	684,725	9,431,136
Katukuh HC	HC	5105	8.7	779,400	9,260,584
Kekesu SC	SC	4724	11.0	730,331	9,379,246
Konga SC	SC	6247	0.0	774,094	9,262,403
Kulula SC	SC	5990	15.2	808,093	9,274,335
Kunua HC	HC	11509	1.4	693,825	9,360,395
Kuraio SC	SC	9371	14.7	700,943	9,335,614
Lemanmanu SC	SC	13966	9.3	675,994	9,443,294
Lenoke SC	SC	2572	2.7	791,337	9,262,744
Manetai HC	HC	9225	5.2	765,043	9,323,045
Monoitu SC	SC	7980	6.2	769,300	9,260,252
Moratona HC	HC	8395	5.0	754,825	9,290,311
Nissan HC	HC	3845	11.2	635,957	9,502,026
Paruparu SC	SC	5863	9.5	767,546	9,301,078
Piano SC	SC	5071	2.7	788,023	9,255,117
Piva (Torokina) HC	HC	3454	27.0	728,853	9,312,851

Ruruvu SC	SC	8058	16.2	731,272	9,339,125
Selau (Hantoa) SC	SC	11454	9.7	696,010	9,396,085
Sipai SC	SC	9780	10.4	693,400	9,353,664
Skotolan SC	SC	7597	4.3	674,007	9,412,899
Sovele SC	SC	5592	18.1	763,952	9,283,438
Tabago SC	SC	7109	4.7	800,402	9,262,203
Tearouki HC	HC	7116	1.8	727,379	9,382,071
Tonu SC	SC	12673	2.0	768,456	9,263,384
Turiboiru SC	SC	6203	3.3	796,428	9,255,062
Wakunai HC	HC	9237	16.6	744,690	9,350,738

### *Aidposts*

Table BVLLE AIDPOSTS OPEN 2006 AGD84. Projection: AGD84 AMG Zone56.

Derived from Div. Health, Health Information Office (Sohano), 'Aidpost Establishment Bougainville 2006'. 130 records.

AIDPOST	BASE_HC_SC	STATUS	DISTRICT	LON	LAT
BONAMUNG	ARAWA	OPEN	CENTRAL	792,150	9,306,200
DAKENATU	ARAWA	OPEN	CENTRAL	809,202	9,294,015
DAMUNG	ARAWA	OPEN	CENTRAL	784,258	9,296,335
DARENAI	ARAWA	OPEN	CENTRAL	798,726	9,287,244
DONGETA	ARAWA	OPEN	CENTRAL	793,520	9,288,460
DOTA	ARAWA	OPEN	CENTRAL	812,578	9,291,830
DUNARA	ARAWA	OPEN	CENTRAL	783,454	9,288,391
IRANG	ARAWA	OPEN	CENTRAL	778,855	9,297,757
KOKORE	ARAWA	OPEN	CENTRAL	773,950	9,296,750
KOROKORO	ARAWA	OPEN	CENTRAL	784,649	9,308,948
KOROMIRA	ARAWA	OPEN	CENTRAL	810,922	9,294,706
KUPEI	ARAWA	OPEN	CENTRAL	783,819	9,307,627
KURAI	ARAWA	OPEN	CENTRAL	802,587	9,295,529
MATANA	ARAWA	OPEN	CENTRAL	772,343	9,314,849
MUMURAI	ARAWA	OPEN	CENTRAL	782,836	9,294,646
NASIOI	ARAWA	OPEN	CENTRAL	790,000	9,298,550
ORAMI	ARAWA	OPEN	CENTRAL	772,906	9,298,759
ROREINANG	ARAWA	OPEN	CENTRAL	796,889	9,297,914
ROROVANA	ARAWA	OPEN	CENTRAL	779,338	9,316,259
SIAE	ARAWA	OPEN	CENTRAL	782,324	9,307,176
TAKEE / KOIANU	ARAWA	OPEN	CENTRAL	815,403	9,282,679
TARARA	ARAWA	OPEN	CENTRAL	765,375	9,332,195
TAVATAVA	ARAWA	OPEN	CENTRAL	804,097	9,298,228
TOBOROI	ARAWA	OPEN	CENTRAL	794,527	9,308,149
TOKIAI	ARAWA	OPEN	CENTRAL	736,450	9,360,250
ATAMO	MANETAI	OPEN	CENTRAL	764,089	9,312,831
KARATO	MANETAI	OPEN	CENTRAL	755,050	9,306,750
KOPANI	MANETAI	OPEN	CENTRAL	757,407	9,320,577
PTAPA	RURUVU	OPEN	CENTRAL	785,231	9,375,068
SISIVI	RURUVU	OPEN	CENTRAL	727,674	9,337,682
SIPURU	SIPURU	OPEN	CENTRAL	786,080	9,294,850
ASITAI	WAKUNAI	OPEN	CENTRAL	719,524	9,355,672
KAKARAPAIA	WAKUNAI	OPEN	CENTRAL	730,796	9,350,697
KEPESIA	WAKUNAI	OPEN	CENTRAL	738,544	9,365,898
TEOKAI	WAKUNAI	OPEN	CENTRAL	736,564	9,360,297
TEPEROI	WAKUNAI	OPEN	CENTRAL	752,028	9,347,430

LONAHAN	BUKA	OPEN	NORTH	687,081	9,413,114
MALASANG	BUKA	OPEN	NORTH	686,621	9,409,714
SAPOSA	BUKA	OPEN	NORTH	688,744	9,380,916
SUHIN	BUKA	OPEN	NORTH	688,950	9,420,475
TAIOF	BUKA	OPEN	NORTH	681,592	9,387,771
BARIKUA	GAGAN	OPEN	NORTH	679,711	9,418,142
KOHINO	GAGAN	OPEN	NORTH	683,751	9,415,350
HAHALIS	HANAHAN	OPEN	NORTH	686,995	9,428,726
TOHATSI	HANAHAN	OPEN	NORTH	684,257	9,439,292
NAMKERIO	HANTOA	OPEN	NORTH	714,682	9,384,001
RAWA	HANTOA	OPEN	NORTH	711,975	9,386,820
ROMSIS	HANTOA	OPEN	NORTH	708,400	9,378,361
SIARA	HANTOA	OPEN	NORTH	699,648	9,392,690
SOROM	HANTOA	OPEN	NORTH	689,236	9,401,552
TON	HANTOA	OPEN	NORTH	701,340	9,390,526
TSISIKO	HANTOA	OPEN	NORTH	711,249	9,382,036
TSUNPETS	HANTOA	OPEN	NORTH	708,373	9,385,557
IAUN	KEKESU	OPEN	NORTH	735,441	9,369,641
KASKURUS	KEKESU	OPEN	NORTH	732,132	9,373,628
NAMATOA	KEKESU	OPEN	NORTH	726,767	9,376,373
KOTSTOVAN	KUNUA	OPEN	NORTH	689,937	9,372,750
KURUR	KUNUA	OPEN	NORTH	690,971	9,366,837
PUTO	KUNUA	OPEN	NORTH	690,381	9,370,866
SAVON	KUNUA	OPEN	NORTH	696,475	9,380,802
SUUN (BENMART)	KUNUA	OPEN	NORTH	690,695	9,375,635
BETARAIO	KURAIO	OPEN	NORTH	695,547	9,344,752
KOREPOVI	KURAIO	OPEN	NORTH	704,522	9,333,091
ELTUPAN	LEMANMANU	OPEN	NORTH	682,737	9,444,168
LONTIS	LEMANMANU	OPEN	NORTH	670,598	9,437,597
BALIL	NISSAN	OPEN	NORTH	630,029	9,507,528
CARTARETS	NISSAN	OPEN	NORTH	773,871	9,471,474
FEADE	NISSAN	OPEN	NORTH	684,519	9,632,276
KARWAIA	NISSAN	OPEN	NORTH	629,556	9,500,240
MAPIRI	NISSAN	OPEN	NORTH	637,162	9,498,688
MORTLOCK	NISSAN	OPEN	NORTH	690,484	9,619,869
PINIPEL	NISSAN	OPEN	NORTH	625,151	9,514,361
PIUL	NISSAN	OPEN	NORTH	771,581	9,471,899
SAUMA	NISSAN	OPEN	NORTH	687,825	9,625,956
TASMAN	NISSAN	OPEN	NORTH	938,309	9,624,384
TUNGOL	NISSAN	OPEN	NORTH	634,778	9,495,643
MATSUNGAN	SKOTOLAN	OPEN	NORTH	674,535	9,404,679
PORORAN	SKOTOLAN	OPEN	NORTH	669,483	9,423,973
TUNG	SKOTOLAN	OPEN	NORTH	674,874	9,408,316
MELELUP	TEAROUKI	OPEN	NORTH	714,008	9,370,231
RAUSARA (WAPO)	TEAROUKI	OPEN	NORTH	725,208	9,379,753
TEABES	TEAROUKI	OPEN	NORTH	726,865	9,386,821
TEOBUIN	TEAROUKI	OPEN	NORTH	722,024	9,380,187
BIROS	BOKU	OPEN	SOUTH	762,105	9,278,125
MARIGA	BOKU	OPEN	SOUTH	752,147	9,272,652
PIKEI V/CLINIC	BOKU	OPEN	SOUTH	759,748	9,276,638
WAMENABERA	BOKU	OPEN	SOUTH	756,344	9,278,194
KANAURO	BUIN	OPEN	SOUTH	790,796	9,255,524

LAGUAI	BUIN	OPEN	SOUTH	793,264	9,248,678
LAMUAI	BUIN	OPEN	SOUTH	806,913	9,248,008
SIURU	KATUKU	OPEN	SOUTH	784,493	9,269,403
LEHU	KULULA	OPEN	SOUTH	800,431	9,277,931
LEULO	KULULA	OPEN	SOUTH	802,534	9,272,747
ORIA	KULULA	OPEN	SOUTH	806,443	9,272,103
OKOMO	LENOKE	OPEN	SOUTH	788,657	9,269,365
KATAURI	MORATONA	OPEN	SOUTH	757,934	9,293,143
KUNEKA	MORATONA	OPEN	SOUTH	756,111	9,293,141
SIANEKI	MORATONA	OPEN	SOUTH	774,338	9,286,960
SIRAKATAU	MORATONA	OPEN	SOUTH	768,280	9,288,652
KOGISAGONO	PIANO	OPEN	SOUTH	787,298	9,266,208
MALUATU	PIANO	OPEN	SOUTH	785,432	9,262,461
AT SINIMA	PIVA	OPEN	SOUTH	715,970	9,325,064
GOTANA	PIVA	OPEN	SOUTH	735,735	9,313,127
KOIARE	PIVA	OPEN	SOUTH	743,143	9,303,298
KOROMOKINA	PIVA	OPEN	SOUTH	725,611	9,309,506
LARUMA	PIVA	OPEN	SOUTH	729,044	9,319,540
TSITTOVI	PIVA	OPEN	SOUTH	745,092	9,312,959
BANA	SOVELE	OPEN	SOUTH	762,723	9,286,673
KORO	SOVELE	OPEN	SOUTH	767,354	9,290,841
POPE	SOVELE	OPEN	SOUTH	769,967	9,285,200
REMISIN (LARENAI)	SOVELE	OPEN	SOUTH	761,596	9,283,824
ROTARE	SOVELE	OPEN	SOUTH	777,912	9,282,209
SIANDARU	SOVELE	OPEN	SOUTH	770,941	9,282,681
SIPI	SOVELE	OPEN	SOUTH	776,106	9,283,847
MUGUAI	TABAGO	OPEN	SOUTH	803,485	9,254,511
ORAVA	TABAGO	OPEN	SOUTH	826,131	9,254,035
DOMONINO / IRU	TONU	OPEN	SOUTH	773,074	9,276,465
HAISI	TONU	OPEN	SOUTH	758,796	9,264,903
HARI	TONU	OPEN	SOUTH	769,976	9,257,567
HURAI	TONU	OPEN	SOUTH	773,542	9,257,840
MAISUA	TONU	OPEN	SOUTH	776,649	9,264,511
MAPIH	TONU	OPEN	SOUTH	694,383	9,360,163
MOKORINO	TONU	OPEN	SOUTH	777,209	9,265,738
MUNNU	TONU	OPEN	SOUTH	773,666	9,265,387
SINNINAI	TONU	OPEN	SOUTH	765,982	9,269,233
TARAPA	TONU	OPEN	SOUTH	778,720	9,258,384
TUMBU	TONU	OPEN	SOUTH	783,735	9,266,464
MALUOKU	TURIBOIRU	OPEN	SOUTH	798,461	9,254,487
MASIKURU	TURIBOIRU	OPEN	SOUTH	794,330	9,264,788
PARIRO	TURIBOIRU	OPEN	SOUTH	795,043	9,248,811

### *Elementary Schools*

Table BVLLE ELEMNTRY SCHLS Q2-2006 AGD84. Projection: AGD84 AMG Zone56. Derived from circulated spreadsheet printout “Elementary School Enrolments by Quarter by District” (Division of Education, Elementary Schools Office, Buka, ABG), showing enrolments for Prep, year 1 and year 2. 206 records.

SCHOOL	DISTRICT	REGION	PREP	YR 1	Yr 2	TOTAL	LON	LAT
KILINALAU	ATOLLS	ATOLLS	27	39	11	77	755,477	9,476,973
MATANATSIL	ATOLLS	ATOLLS	27	33	47	107	769,429	9,478,621

NUGURIA	ATOLLS	ATOLLS	21	29	0	50	697,211	9,622,581
NUKUMANU	ATOLLS	ATOLLS	25	0	24	49	1,217,648	9,487,489
NUKUTOA	ATOLLS	ATOLLS	0	25	23	48	947,633	9,473,000
BALIL	NISSAN	ATOLLS	25	23	17	65	629,887	9,506,959
BOROKALIL	NISSAN	ATOLLS	20	0	20	40	636,637	9,500,334
GEREI	NISSAN	ATOLLS	23	0	19	42	635,544	9,494,902
KULIS	NISSAN	ATOLLS	30	0	17	47	633,356	9,494,936
LALIL	NISSAN	ATOLLS	7	9	8	24	636,026	9,502,256
LIHON	NISSAN	ATOLLS	35	31	0	66	634,680	9,504,600
MANTOIA	NISSAN	ATOLLS	12	0	10	22	624,420	9,516,973
PORIWON	NISSAN	ATOLLS	18	27	33	78	632,738	9,506,135
ROGOS	NISSAN	ATOLLS	10	0	11	21	625,815	9,512,659
SIAR	NISSAN	ATOLLS	19	17	0	36	630,830	9,506,900
SIROT	NISSAN	ATOLLS	10	5	0	15	629,109	9,506,557
TANAHERAN	NISSAN	ATOLLS	12	0	14	26	632,434	9,496,258
TANAMALIT	NISSAN	ATOLLS	14	0	0	14	636,689	9,497,339
TEAH	NISSAN	ATOLLS	14	0	9	23	625,627	9,517,042
YOTCHIBOL	NISSAN	ATOLLS	0	4	5	9	630,068	9,500,562
AVAIPA	KIETA	CENTRAL	99	0	91	190	773,341	9,307,812
SINORU	KIETA	CENTRAL	33	18	0	51	758,941	9,317,185
URUNA	KIETA	CENTRAL	34	51	0	85	793,671	9,314,237
AVIRO	WAKUNAI	CENTRAL	21	0	18	39	739,235	9,355,123
BARANI	WAKUNAI	CENTRAL	20	21	0	41	741,672	9,352,762
IBU	WAKUNAI	CENTRAL	0	27	0	27	740,343	9,354,858
KORU	WAKUNAI	CENTRAL	33	0	24	57	744,473	9,348,521
KUISIAU	WAKUNAI	CENTRAL	15	16	0	31	746,406	9,351,022
KUKUASI	WAKUNAI	CENTRAL	71	54	0	125	722,155	9,356,108
KUKUAVU	WAKUNAI	CENTRAL	29	14	0	43	738,561	9,357,399
NUPATORO	WAKUNAI	CENTRAL	0	27	0	27	739,596	9,353,502
OKOVUPAIA	WAKUNAI	CENTRAL	30	29	0	59	754,898	9,338,921
PAPAPANA	WAKUNAI	CENTRAL	42	0	0	42	741,417	9,352,561
PEREOVI	WAKUNAI	CENTRAL	53	8	8	69	735,256	9,362,205
RAIOVI	WAKUNAI	CENTRAL	0	26	36	62	739,126	9,356,450
REARAVI	WAKUNAI	CENTRAL	0	23	11	34	746,501	9,349,440
RUATAI	WAKUNAI	CENTRAL	19	14	27	60	737,409	9,356,190
SIRORIPAIA	WAKUNAI	CENTRAL	46	0	0	46	735,509	9,336,630
SISIVI	WAKUNAI	CENTRAL	20	23	0	43	727,415	9,337,604
TEOKON	WAKUNAI	CENTRAL	34	21	17	72	743,428	9,350,559
TOGARAO	WAKUNAI	CENTRAL	28	24	22	74	729,886	9,340,309
TORERAIVA	WAKUNAI	CENTRAL	13	17	19	49	740,056	9,353,980
TURIMA	WAKUNAI	CENTRAL	30	21	31	82	738,897	9,356,784
USTAKORU	WAKUNAI	CENTRAL	0	20	0	20	741,527	9,352,256
VOKO	WAKUNAI	CENTRAL	26	18	19	63	736,503	9,355,831
WAKUNAI	WAKUNAI	CENTRAL	32	17	18	67	744,690	9,350,738
BASBI	BUKA1	NORTH	25	22	0	47	686,801	9,428,770
ELTUPAN	BUKA1	NORTH	52	26	34	112	682,366	9,443,842
HAGUS	BUKA1	NORTH	12	15	10	37	684,700	9,432,921
HANPAN	BUKA1	NORTH	22	23	21	66	682,030	9,445,307
HATANIA	BUKA1	NORTH	27	24	21	72	684,882	9,430,387
IELELINA	BUKA1	NORTH	30	29	17	76	684,656	9,432,031
KETSKETS	BUKA1	NORTH	24	26	22	72	684,836	9,434,364
KOTOPAN	BUKA1	NORTH	33	9	7	49	685,615	9,437,359

LULLY	BUKA1	NORTH	27	13	10	50	675,732	9,442,968
NAHIRE	BUKA1	NORTH	23	16	23	62	687,072	9,428,561
OLU	BUKA1	NORTH	77	31	33	141	673,642	9,440,523
RARUM	BUKA1	NORTH	24	13	8	45	684,815	9,430,166
SOENA	BUKA1	NORTH	69	47	36	152	670,758	9,437,738
TANKIHIRA	BUKA1	NORTH	24	21	15	60	676,741	9,444,422
TOHATSI	BUKA1	NORTH	30	17	29	76	684,102	9,438,957
TONGA	BUKA1	NORTH	28	16	17	61	681,431	9,435,664
YAKOBALA	BUKA1	NORTH	32	43	47	122	676,164	9,443,546
GAGAN	BUKA2	NORTH	52	24	28	104	679,527	9,420,961
KARAMILU	BUKA2	NORTH	34	23	13	70	668,264	9,424,554
KAVINU	BUKA2	NORTH	34	8	22	64	677,105	9,420,195
KOHISO	BUKA2	NORTH	35	24	20	79	677,805	9,424,062
MATSUNGAN	BUKA2	NORTH	0	21	12	33	674,535	9,404,679
PETATS	BUKA2	NORTH	85	28	49	162	671,928	9,410,457
SAPANI	BUKA2	NORTH	0	27	0	27	680,589	9,412,058
TUMASU	BUKA2	NORTH	27	21	24	72	682,113	9,418,156
YUTUK	BUKA2	NORTH	29	24	14	67	672,767	9,419,531
BARTANIA	BUKA3	NORTH	34	18	19	71	689,165	9,422,919
BUBUIL	BUKA3	NORTH	36	23	17	76	686,217	9,408,325
CHEBU	BUKA3	NORTH	46	41	41	128	684,492	9,398,448
HAHOPUSE	BUKA3	NORTH	18	10	15	43	687,026	9,412,471
HAMARASA	BUKA3	NORTH	25	21	20	66	687,081	9,413,539
HANGAN	BUKA3	NORTH	18	19	12	49	686,192	9,404,676
HUTJENA	BUKA3	NORTH	28	28	19	75	685,910	9,403,316
IETA	BUKA3	NORTH	25	23	22	70	685,372	9,399,780
LOSEI	BUKA3	NORTH	30	0	10	40	688,138	9,417,563
NOKIA	BUKA3	NORTH	36	0	22	58	682,901	9,407,382
POPOSOKO	BUKA3	NORTH	17	20	13	50	688,883	9,419,038
ROHA	BUKA3	NORTH	29	13	9	51	686,664	9,406,714
SIING	BUKA3	NORTH	24	18	0	42	687,753	9,416,006
SUHIN	BUKA3	NORTH	20	26	28	74	688,811	9,420,916
SUPUNKAKIL	BUKA3	NORTH	25	22	13	60	686,442	9,407,162
TAKAPINAHU	BUKA3	NORTH	43	25	0	68	689,317	9,426,506
TELATU	BUKA3	NORTH	30	0	24	54	684,540	9,413,631
ASITAPAI	KUNUA	NORTH	31	41	0	72	696,792	9,349,517
BENMATE	KUNUA	NORTH	21	8	22	51	690,559	9,375,592
BETARAO	KUNUA	NORTH	107	0	0	107	695,749	9,344,730
JUPUNO	KUNUA	NORTH	14	27	0	41	681,458	9,383,266
KEAKARA	KUNUA	NORTH	59	37	0	96	695,027	9,352,646
LATEOVI	KUNUA	NORTH	91	0	0	91	702,987	9,333,651
MAKEKOA	KUNUA	NORTH	60	30	25	115	689,383	9,361,079
MUIRE	KUNUA	NORTH	42	12	23	77	701,181	9,336,433
PUTO	KUNUA	NORTH	25	26	0	51	690,415	9,370,990
SAVON	KUNUA	NORTH	0	25	35	60	696,795	9,381,016
SISIAPAI	KUNUA	NORTH	61	0	0	61	692,550	9,355,550
TOROTSIAN	KUNUA	NORTH	20	22	22	64	687,865	9,381,681
VONISKOPO	KUNUA	NORTH	66	28	0	94	691,236	9,367,269
YIHIN	KUNUA	NORTH	12	7	22	41	681,509	9,388,938
MAMARINE	SELAU/SUIR	NORTH	30	19	17	66	695,927	9,394,921
MANOB	SELAU/SUIR	NORTH	25	27	18	70	687,078	9,399,973
MOEVAH	SELAU/SUIR	NORTH	24	18	16	58	714,125	9,379,489



PAPASA	SELAU/SUIR	NORTH	21	15	0	36	689,072	9,395,661
TONGONO	SELAU/SUIR	NORTH	43	33	30	106	693,675	9,391,717
ANGABULE	TINPUTZ	NORTH	27	0	0	27	727,843	9,377,512
DAHWON	TINPUTZ	NORTH	0	20	0	20	722,221	9,384,098
DEOS	TINPUTZ	NORTH	44	29	16	89	717,558	9,387,752
HANATANA	TINPUTZ	NORTH	20	19	12	51	730,247	9,379,417
IRIS	TINPUTZ	NORTH	24	17	19	60	722,428	9,386,660
IZU	TINPUTZ	NORTH	13	20	0	33	727,296	9,377,605
KARIAPA	TINPUTZ	NORTH	0	20	16	36	727,781	9,379,798
KESPOHIT	TINPUTZ	NORTH	18	16	2	36	718,044	9,383,147
KOVANIS	TINPUTZ	NORTH	24	17	11	52	724,378	9,386,486
PATEAVEAVE	TINPUTZ	NORTH	23	0	23	46	723,086	9,376,961
POKAPA	TINPUTZ	NORTH	12	26	22	60	718,552	9,380,745
PUSKAOTO	TINPUTZ	NORTH	29	23	0	52	724,570	9,381,300
SIPOTAVAI	TINPUTZ	NORTH	23	18	12	53	720,694	9,379,113
SUAGU	TINPUTZ	NORTH	22	20	0	42	726,087	9,380,367
TAURAI	TINPUTZ	NORTH	0	24	0	24	726,966	9,376,401
TEABES	TINPUTZ	NORTH	21	0	16	37	726,865	9,386,821
TEAROUKI	TINPUTZ	NORTH	0	14	6	20	727,379	9,382,071
TEOBUHIN	TINPUTZ	NORTH	33	37	20	90	722,217	9,380,646
TEOP	TINPUTZ	NORTH	21	11	12	44	729,688	9,383,015
TETEPAKO	TINPUTZ	NORTH	20	0	0	20	726,634	9,374,916
TORPANOS	TINPUTZ	NORTH	30	26	31	87	719,197	9,381,380
VAEPUS	TINPUTZ	NORTH	23	20	0	43	723,568	9,380,319
WAROPA	TINPUTZ	NORTH	40	39	52	131	734,889	9,368,644
WASUNAM	TINPUTZ	NORTH	21	11	0	32	725,135	9,379,996
AGABAI	BANA	SOUTH	31	26	0	57	758,780	9,286,610
AMALUS	BANA	SOUTH	24	0	0	24	764,323	9,288,453
BAKORAM	BANA	SOUTH	57	30	17	104	767,556	9,278,319
BALALIU	BANA	SOUTH	18	0	0	18	773,410	9,288,083
BOKU	BANA	SOUTH	0	54	46	100	760,562	9,273,226
JARARA	BANA	SOUTH	22	17	22	61	754,623	9,270,230
KALELIA	BANA	SOUTH	36	22	29	87	767,056	9,286,930
KORO	BANA	SOUTH	18	18	36	72	767,637	9,290,973
LABALAM	BANA	SOUTH	0	0	20	20	773,358	9,290,466
LAY MISSN	BANA	SOUTH	22	19	24	65	757,044	9,283,446
LELA	BANA	SOUTH	22	25	0	47	764,609	9,290,541
LOPELE	BANA	SOUTH	51	0	0	51	767,739	9,282,843
LOULO	BANA	SOUTH	24	40	18	82	763,279	9,283,205
MABES	BANA	SOUTH	13	37	0	50	751,710	9,267,159
MARAU	BANA	SOUTH	20	23	0	43	746,930	9,288,382
MENDAI	BANA	SOUTH	0	42	28	70	761,634	9,288,809
MOMASI	BANA	SOUTH	39	22	0	61	756,519	9,279,323
MOUSINO	BANA	SOUTH	33	0	19	52	756,524	9,285,649
NAMAMINA	BANA	SOUTH	30	32	21	83	756,455	9,293,063
OSIKOMBA	BANA	SOUTH	27	18	27	72	764,456	9,287,795
OSIREI	BANA	SOUTH	36	51	10	97	772,204	9,284,358
PIKE	BANA	SOUTH	36	0	25	61	759,502	9,276,550
POMALATE	BANA	SOUTH	25	26	22	73	764,415	9,281,936
SIKOREWA	BANA	SOUTH	0	35	16	51	769,886	9,291,059
SILAKATAU	BANA	SOUTH	30	50	0	80	768,607	9,288,981
SINKODO	BANA	SOUTH	21	59	32	112	775,484	9,282,436

SIPI	BANA	SOUTH	0	25	25	50	775,502	9,283,556
SIWELEI	BANA	SOUTH	29	0	31	60	766,133	9,290,360
TADOLIMA	BANA	SOUTH	13	12	15	40	763,863	9,283,996
TANGINA	BANA	SOUTH	20	25	25	70	773,619	9,279,678
WAKUPA	BANA	SOUTH	26	25	25	76	771,673	9,282,578
WARUWARU	BANA	SOUTH	28	26	17	71	771,203	9,287,412
WATOLO	BANA	SOUTH	0	42	15	57	766,306	9,285,572
AKU	BUIN WEST	SOUTH	43	0	35	78	784,778	9,252,458
ANO	BUIN WEST	SOUTH	33	29	21	83	788,149	9,254,846
BAITAGA	BUIN WEST	SOUTH	64	0	0	64	802,190	9,249,494
BOREBURU	BUIN WEST	SOUTH	38	24	33	95	784,847	9,257,898
BUIN TOWN	BUIN WEST	SOUTH	0	0	25	25	797,053	9,253,178
KAKAURA	BUIN WEST	SOUTH	24	26	16	66	801,739	9,249,702
KIKIMOGU	BUIN WEST	SOUTH	0	44	21	65	792,089	9,257,318
KONIGURU	BUIN WEST	SOUTH	0	19	12	31	793,301	9,267,898
LAGUAI	BUIN WEST	SOUTH	62	41	42	145	793,264	9,248,678
MASIKURU	BUIN WEST	SOUTH	70	34	9	113	794,330	9,264,788
NAINO	BUIN WEST	SOUTH	70	0	12	82	785,465	9,267,283
NAKARO	BUIN WEST	SOUTH	54	0	0	54	798,099	9,249,023
OKOMO	BUIN WEST	SOUTH	39	0	63	102	788,376	9,269,506
PIARINO	BUIN WEST	SOUTH	0	63	0	63	791,600	9,260,421
TASIPORO	BUIN WEST	SOUTH	0	27	0	27	805,025	9,256,015
TAURATO	BUIN WEST	SOUTH	0	0	0	0	806,668	9,247,966
TOKAINO	BUIN WEST	SOUTH	76	26	32	134	791,295	9,262,910
TUGIU	BUIN WEST	SOUTH	76	0	28	104	789,380	9,261,590
TUITU	BUIN WEST	SOUTH	35	15	50	100	788,212	9,259,254
UBA	BUIN WEST	SOUTH	0	27	0	27	798,029	9,261,633
MAINO	SIWAI	SOUTH	15	4	5	24	776,719	9,264,376
MOTIRUI	SIWAI	SOUTH	29	47	45	121	774,100	9,262,615
MUSIMINOI	SIWAI	SOUTH	35	33	29	97	774,097	9,256,539
OWOTI	SIWAI	SOUTH	24	29	22	75	767,363	9,264,000
SIKU	SIWAI	SOUTH	40	0	20	60	763,421	9,268,238
ATSINIMA	TOROKINA	SOUTH	26	0	0	26	716,727	9,324,640
ATSOVAPA	TOROKINA	SOUTH	27	0	0	27	717,801	9,326,644
DAKAPA	TOROKINA	SOUTH	0	20	0	20	755,010	9,309,717
GOTANA	TOROKINA	SOUTH	18	27	0	45	735,867	9,313,115
KAREKOPA	TOROKINA	SOUTH	0	0	16	16	751,165	9,308,407
KASKO	TOROKINA	SOUTH	23	21	0	44	731,710	9,313,486
KAWATSIA	TOROKINA	SOUTH	0	0	30	30	750,066	9,308,159
KOIARE	TOROKINA	SOUTH	0	10	0	10	743,251	9,303,106
KOROVI	TOROKINA	SOUTH	0	25	0	25	745,405	9,313,513
KUVI	TOROKINA	SOUTH	37	0	0	37	728,883	9,320,271
MAMAREGO	TOROKINA	SOUTH	0	10	0	10	743,464	9,277,791
MAROWA	TOROKINA	SOUTH	16	13	0	29	725,640	9,309,662
REINI	TOROKINA	SOUTH	0	34	0	34	747,870	9,310,849
TAVU	TOROKINA	SOUTH	15	0	0	15	729,255	9,321,112
TEKOMO	TOROKINA	SOUTH	0	0	16	16	722,187	9,312,214
UTUKOPA	TOROKINA	SOUTH	22	0	0	22	735,580	9,321,092

### *Primary Schools*

Table BVLLE PRIMSCH Q1-2006 AGD84. Projection: AGD84 AMG Zone56.  
Enrolment data from ABG Division of Education spreadsheet. 208 records.

SCHOOL_NAME	TOT_NR STDNT	NR MALE STDNT	NR		OPEN	LAT	LON
			FEMALE STDNT	NR STAFF			
LAGUAI 439	313	162	151	10	Y	9,248,678	793,264
MALABITA 446	184	96	88	8	Y	9,249,762	802,127
AKU 410	225	112	113	7	Y	9,252,883	784,458
BUIN 001	116	65	51	5	Y	9,252,963	797,282
MAMAROMINO 448	109	61	48	5	Y	9,254,100	798,082
TANTAREKI 592	173	84	89	6	Y	9,254,867	803,075
PIANO 425	190	97	93	7	Y	9,255,117	788,023
KANAURO 418	150	72	78	5	Y	9,255,121	790,762
MUGUAI 456	275	143	132	7	Y	9,254,594	803,764
LAITARO 440	164	82	82	4	Y	9,258,225	796,026
HURAI 363	258	131	127	8	Y	9,258,056	773,600
SIURU 473	92	54	38	4	Y	9,257,175	797,884
KIKIMOGU 505	83	41	42	5	Y	9,257,450	792,052
IBIRAI 427	0	0	0	0	N	9,257,540	798,562
HARINAI 361	152	84	68	6	Y	9,257,731	768,871
MORULA 455	113	63	50	5	Y	9,260,341	787,099
MONOITU 453	427	209	218	14	Y	9,260,945	769,296
TOKAINO 478	246	125	121	9	Y	9,263,098	791,276
TABAGO 476	301	168	133	10	Y	9,262,114	800,354
KONGA 007	286	140	146	11	Y	9,262,403	774,094
TUGIU 487	167	91	76	6	Y	9,261,451	789,463
TONU 375	252	127	125	10	Y	9,263,384	768,456
HAISI 423	125	69	56	6	Y	9,264,430	761,266
MAISUA 367	186	104	82	6	Y	9,264,916	777,224
MASIKURU 452	158	90	68	5	Y	9,264,788	794,330
RABAU LU 466	134	71	63	6	Y	9,265,154	771,010
OKOMO 458	123	57	66	1	Y	9,268,995	788,447
OROROI 513	169	95	74	7	Y	9,270,703	794,135
SININAI 472	0	0	0	0	N	9,269,219	765,730
UGUBAKOGU	92	50	42	4	Y	9,267,125	804,552
BURUBURUNO 512	44	19	25	2	Y	9,271,178	790,440
MURUA 457	168	84	84	5	Y	9,271,688	752,932
BOGISAGO 414	130	63	67	6	Y	9,271,619	797,740
BOKU 013	168	84	84	6	Y	9,273,152	760,271
KULULA 428	0	0	0	0	N	9,274,335	808,093
KERIAU 386	132	64	68	5	Y	9,282,472	774,501
SOVELE 475	371	171	200	14	Y	9,283,239	764,973
MANGOANA 384	110	56	54	5	Y	9,286,962	815,163
SIPI	157	73	84	4	Y	9,283,744	775,315
SIANEKI 469	0	0	0	0	N	9,283,968	772,620
PEILE 538	291	129	162	11	Y	9,287,591	767,836
DONGETA 378	136	76	60	5	Y	9,288,746	793,478
KORO 435	185	90	95	6	Y	9,290,819	768,283
NARINAI 596	163	89	74	6	Y	9,291,406	772,962
KUN EKA 022	191	104	87	6	Y	9,292,911	756,071
SIPURU 366	104	57	47	5	Y	9,293,935	783,653
ROROVANA 460	124	59	65	5	Y	9,316,259	779,338
KURAI 534	110	73	37	4	Y	9,295,265	802,727
DAPER A	105	62	43	3	Y	9,299,150	772,950

ROREINANG 377	201	101	100	7	Y	9,298,243	796,683
KOIARE 516	45	31	14	3	Y	9,303,298	743,143
BONAMUNG 539	55	32	23	4	Y	9,306,106	792,495
KUPEI 527	95	51	44	5	Y	9,307,589	783,773
TOROKINA 459	107	63	44	5	Y	9,308,927	725,890
KAWAI 590	52	30	22	4	Y	9,313,132	733,942
BOIRA 515	70	36	34	4	Y	9,313,879	770,124
ARAWA 020	175	81	94	7	Y	9,310,885	783,344
BAIRIMA 413	73	38	35	5	Y	9,312,050	780,518
ATAMO 412	209	112	97	6	Y	9,312,791	764,520
GOTANA 436	56	25	31	4	Y	9,313,224	735,911
URUNA 593	116	65	51	5	Y	9,314,237	793,671
KOPANI 540	200	105	95	5	Y	9,320,530	757,287
ATSINIMA 495	41	17	24	1	Y	9,324,961	716,520
TARARA 528	133	78	55	5	Y	9,332,407	765,602
KOREPOVI 508	0	0	0	0	N	9,332,951	704,968
KURAI 438	84	44	40	4	Y	9,336,100	700,780
SISIVI 533	69	33	36	4	Y	9,337,862	727,356
RURUVU 373	180	81	99	7	Y	9,339,421	731,055
KARAUTURI 499	134	60	74	6	Y	9,340,090	733,018
IRUREVIA	47	21	26	2	Y	9,340,254	760,436
KORU 524	0	0	0	0	N	9,343,619	746,231
BETARAIO 494	94	69	25	4	Y	9,344,931	695,654
BURUSOTOL 500	126	61	65	5	Y	9,348,903	731,216
TEPEROI 507	101	53	48	4	Y	9,348,015	750,252
ARIARIKO 021	179	91	88	7	Y	9,355,114	740,364
WAKUNAI 018	161	86	75	7	Y	9,350,738	744,690
ASITAI 530	152	88	64	6	Y	9,355,746	719,590
ASITAVI 426	124	75	49	7	Y	9,353,164	742,148
SIPAI 477	0	0	0	0	N	9,353,540	693,396
TURIMA 383	137	73	64	6	Y	9,356,784	738,897
KUNUA 008	0	0	0	0	N	9,360,421	693,925
IAUN 004	146	64	82	7	Y	9,369,641	735,441
WASINOBUS	60	36	24	3	Y	9,375,300	717,014
NAMATOA 369	109	48	61	5	Y	9,376,578	726,728
KEKESU 365	119	53	66	6	Y	9,379,246	730,331
WAPU 491	191	105	86	7	Y	9,379,852	725,277
TOROPANOS 520	164	94	70	5	Y	9,381,366	719,345
TEAROUKI 482	92	49	43	5	Y	9,382,071	727,379
ARAVIA 517	144	69	75	7	Y	9,379,381	706,721
TSUNPETS 502	0	0	0	0	N	9,385,587	708,424
TINPUTZ 468	281	145	136	12	Y	9,386,454	722,174
PORPOR 514	66	31	35	3	Y	9,384,897	698,295
SIARA 470	223	128	95	7	Y	9,392,416	699,720
SOHANO 015	225	125	100	7	Y	9,398,046	684,412
NOVAH 370	110	68	42	5	Y	9,399,475	680,755
SOROM 474	243	129	114	8	Y	9,400,517	690,277
KAHULE 005	110	50	60	5	Y	9,404,922	676,677
MALASANG 447	351	181	170	13	Y	9,406,887	686,507
TUKIHING 376	139	78	61	5	Y	9,410,025	674,979
PETATS 372	181	91	90	7	Y	9,411,183	671,961
LONAHAN 443	254	123	131	9	Y	9,413,114	687,081

PATEKI 522	183	74	109	5	Y	9,414,579	682,640
HAMATANA 501	0	0	0	0	N	9,416,597	687,855
BEKUT 415	208	112	96	7	Y	9,418,396	682,338
BEI 493	139	82	57	7	Y	9,419,416	672,909
HAPAN 416	155	89	66	5	Y	9,420,484	677,038
GAGAN 479	210	118	92	8	Y	9,420,961	679,527
GOGOHE 421	0	0	0	0	N	9,421,826	689,127
PORORAN 463	179	101	78	7	Y	9,423,973	669,483
TAHETAHE 027	212	108	104	10	Y	9,424,094	689,293
TUGEAS 519	0	0	0	0	N	9,424,845	676,902
HAHALIS 003	213	108	105	9	Y	9,428,726	686,995
HANAHAN 417	303	162	141	10	Y	9,431,136	684,725
BANIS 521	38	20	18	2	Y	9,431,199	672,802
HAKETS 019	251	115	136	9	Y	9,433,063	684,462
LONTIS 444	0	0	0	0	N	9,437,597	670,598
TOHATSI 485	201	102	99	8	Y	9,439,292	684,257
LEMANKOA 442	0	0	0	0	N	9,440,874	673,678
LEMANMANU 480	231	128	103	10	Y	9,443,294	675,994
ELTUPAN 420	220	105	115	7	Y	9,444,168	682,737
TANAMALO 374	153	79	74	7	Y	9,444,870	677,036
IANGAIN 497	96	52	44	0	Y	9,477,127	755,547
TUNGOL 488	118	65	53	4	Y	9,495,351	634,728
BALIL 518	164	100	64	8	Y	9,507,325	630,028
SIGON 471	169	87	82	6	Y	9,505,859	632,570
AKANAI 598	52	33	19	3	Y	9,306,851	791,831
AMENO 411	180	85	95	7	Y	9,277,174	757,500
AUTARAVIA 526	61	29	32	4	Y	9,346,366	745,194
BARA 543	127	70	57	4	Y	9,295,064	786,123
BIROSI 031	123	64	59	5	Y	9,277,934	762,481
BUIANA	38	22	16	1	Y	9,302,031	795,234
CARTERETS 419	148	72	76	5	Y	9,471,474	773,871
DANTANAI 535	147	91	56	6	Y	9,298,577	802,834
DARENAI 597	168	75	93	6	Y	9,304,292	776,749
DEOMORI	133	72	61	4	Y	9,293,049	769,072
DOA-SO 537	112	56	56	5	Y	9,374,407	692,077
DOKOTONAU	116	54	62	5	Y	9,301,739	792,283
DU'UNARA 360	115	54	61	5	Y	9,287,906	783,648
HAHELA 422	427	226	201	14	Y	9,401,783	684,410
HAHON 002	215	111	104	9	Y	9,428,497	698,583
HANTOA 424	257	120	137	10	Y	9,396,277	695,486
IAGAMA	0	0	0	0	N	9,354,319	741,487
IPA 032	135	61	74	4	Y	9,354,235	733,867
IRU 379	103	64	39	3	Y	9,276,584	773,821
IUMORE 531	133	62	71	4	Y	9,258,015	796,542
IUNO 024	131	52	79	4	Y	9,277,292	799,209
KARWAIA 429	108	69	39	5	Y	9,500,471	629,404
KATUKU 430	178	90	88	7	Y	9,260,409	777,951
KAWATSIA 595	58	33	25	1	Y	9,307,783	750,228
KEPESIA	207	101	106	9	Y	9,366,224	738,670
KEURU 431	142	65	77	7	Y	9,311,161	788,601
KIETA 006	0	0	0	0	N	9,312,056	791,139
KIPAU 012	67	35	32	1	Y	9,263,314	796,314

KOIANU 433	236	125	111	8	Y	9,282,503	813,350
KOMARU 536	52	37	15	3	Y	9,263,928	798,711
KONKOPINE 454	187	94	93	8	Y	9,290,982	762,417
KOROMIRA 437	227	105	122	8	Y	9,294,480	811,065
KURUKURUPAU	0	0	0	0	N	9,336,134	715,960
LARUMA 441	77	35	42	3	Y	9,319,745	728,840
LAUTAN 511	135	68	67	5	Y	9,253,034	825,863
LEHU 371	81	40	41	4	Y	9,277,500	800,401
MALUATU 506	211	122	89	8	Y	9,262,301	785,304
MALUOKU 434	0	0	0	0	N	9,254,719	798,440
MAMAREGO 525	52	24	28	2	Y	9,278,017	743,573
MANETAI 449	182	107	75	8	Y	9,323,181	765,296
MAPIRI 450	127	59	68	6	Y	9,336,808	762,810
MARAI 451	143	75	68	5	Y	9,303,274	793,968
MATHEW TABIK 028	80	29	51	5	Y	9,398,117	693,670
METONAI	98	52	46	5	Y	9,312,222	774,930
METU	0	0	0	0	N	9,357,626	728,577
MIKAS 591	56	23	33	3	Y	9,290,109	811,499
MONGAI 542	161	89	72	4	Y	9,259,873	801,632
MORTLOCKS 009	52	29	23	5	Y	9,467,987	943,811
NAVIBI 594	165	90	75	6	Y	9,301,534	788,490
LAUKETSI	0	0	0	0	N	9,345,978	697,728
NUGURIA 010	63	31	32	3	Y	9,619,627	694,281
ORAMI 492	224	105	119	7	Y	9,298,759	772,906
OUNE	21	12	9	1	Y	9,294,985	769,525
PANGUNA	0	0	0	0	N	9,299,224	777,516
PARUPARU 445	256	140	116	5	Y	9,300,867	767,119
PETER LAHIS 0	196	100	96	9	Y	9,310,977	784,379
PINKASIO 387	172	92	80	6	Y	9,297,052	778,618
PIRUANA 461	183	111	72	7	Y	9,306,756	783,155
POPE 462	0	0	0	0	N	9,285,352	770,057
RAIOVI 541	117	71	46	5	Y	9,355,381	737,186
RIGAMU 362	133	80	53	6	Y	9,380,224	726,045
SAPOSA 014	150	71	79	7	Y	9,381,160	689,000
SIANDARU 368	161	93	68	5	Y	9,282,934	770,736
SIPATAKO	229	143	86	10	Y	9,310,351	773,601
TAIOF 481	106	51	55	5	Y	9,387,905	681,609
TASMAN 016	0	0	0	0	N	9,488,095	1,222,423
TAURATO	41	30	11	2	Y	9,244,353	820,184
TAVATAVA	74	39	35	5	Y	9,298,182	804,015
TEA'O 381	99	58	41	5	Y	9,374,076	733,247
TEKOKNIH 467	268	139	129	9	Y	9,379,366	714,350
TEOKAI 483	150	85	65	7	Y	9,360,250	736,450
TEOSIPOTO 025	227	121	106	8	Y	9,380,669	722,258
TOPIS	31	20	11	1	Y	9,378,853	717,509
TORESURE 382	46	21	25	2	Y	9,372,956	725,132
TSITОВI 498	123	62	61	4	Y	9,313,080	745,162
TUBIANA	115	48	67	6	Y	9,311,443	792,823
TUITU 532	181	98	83	6	Y	9,259,388	788,111
TUPUKAS 017	245	120	125	8	Y	9,310,756	783,825
TURIBOIRU 489	245	128	117	7	Y	9,255,062	796,428
URUH 490	0	0	0	0	N	9,512,649	625,905



VOYCE MEMORIAL 380	45	24	21	3	Y	9,249,916	809,530
WARANA 385	96	44	52	6	Y	9,298,703	802,772
WISSAI 030	118	57	61	5	Y	9,272,799	806,188

### *Secondary Schools*

Table BVLLE HIGHSCH Q1-2006 AGD84. Projection: AGD84 AMG Zone56.  
Enrolment data derived from ABG Division of Education spreadsheet.

	TOTAL NR	NR MALE	NR FEMALE			
HS_NAME	STUDENTS	STUDENTS	STUDENTS	NR STAFF	LON	LAT
ARAWA HS	378	206	172	19	783,945	9,310,817
ASITAVI HS	421	127	294	17	742,066	9,352,969
BANA HS	286	148	138	15	762,723	9,286,673
BUIN HS	542	341	201	23	796,986	9,252,950
HUTJENA HS	643	297	346	26	685,910	9,403,316
MABIRI HS	187	187	0	7	761,146	9,335,494
NISSAN HS	356	198	158	16	635,957	9,502,026
TARLENA HS	654	360	294	26	690,652	9,393,394
TONU HS	423	208	215	14	767,591	9,263,269

### *Vocational Schools*

Table BVLLE VOCATIONL SCHLS Q1-2006 AGD84. Projection: AGD84 AMG  
Zone56. Enrolment data derived from ABG Division of Education spreadsheet.

NAME OF VOC	TOTAL NR	NR MALE	NR FEMALE	NR		
TRAINING SCH	STUDENTS	STUDENTS	STUDENTS	STAFF	LON	LAT
ARAWA VTC	117	51	66	5	783,553	9,310,569
BUIN VTC	70	70	0	4	797,125	9,252,838
BURUNOITU VTC	64	64	0	5	673,019	9,427,649
KOROMIRA VTC	96	84	12	4	811,104	9,296,017
MABIRI VTC	78	78	0	7	760,253	9,337,570
TARLENA VTC	148	0	148	8	693,991	9,391,404
TINPUTZ VTC	150	150	0	8	721,888	9,386,098

### *Trunk Road*

Table BVLLE ROAD CROSSINGS 2006 AGD84Z56. Projection: AGD84 AMG Zone56.  
Location data derived from GPS waypoints and wall map, Road Consult office, Buka.

NAME	TYPE	LON	LAT
Koreba River Sth wet crossing	Wet Crossing	761,155	9,336,534
Vito River wet crossing	Wet Crossing	765,153	9,325,679
Bove River wet crossing	Wet Crossing	766,036	9,328,480
Iraka River wet crossing	Wet crossing	757,657	9,341,434
Korova wet crossing	Wet crossing	756,709	9,341,545
Pukarobi River wet crossing	Wet Crossing	763,030	9,334,627
Malas River causeway	Wet xing/dstryd csway	752,371	9,346,080
Ururva River bridge wet xingg	Wet xing/bailey dstro	741,928	9,351,755
Kaskurus wet crossing	Wet Crossing	732,084	9,373,809
Aruai River csway (destroyed)	ford / causeway	730,401	9,378,569
Tinputz River wet crossing	Wet Crossing	723,799	9,384,235
Irung River causeway	Causeway	722,407	9,384,809
Raua River wet crossing	Wet Crossing	711,855	9,386,836
Koreba River Nth wet crossing	Wet crossing	760,890	9,337,480
Koreba River Ctr wet crossing	Wet Crossing	760,936	9,337,033
Tsinamutu Cswy 3/26	Causeway	701,169	9,334,958

/unbarowowe Bailey B	Bridge, bailey	699,588	9,338,974
Makatava ford crossi	Wet crossing	700,085	9,338,106
Potua Bailey Br 3/23	Bridge, bailey	697,915	9,342,265
Ford crossing 3/22	Wet crossing	697,279	9,342,724
Ford crossing 3/21	Wet crossing	696,553	9,343,457
Alauni Bailey Br 3/2	Bridge, bailey	696,011	9,344,782
Kaisa Bailey Br 3/19	Bridge, bailey	691,846	9,346,351
Kaviki ford crossing	Wet crossing	694,128	9,351,904
Nambis Trib causeway	Causeway	693,951	9,353,091
Nambis causeway 3/15	Causeway	693,952	9,353,433
Sarime causeway 3/14	Causeway	696,257	9,359,146
Opaiope causeway 3/1	Causeway	691,863	9,360,488
Ruepo Bailey Br 3/12	Bridge, bailey	691,342	9,361,288
Diau Bailey Br 3/10	Bridge, bailey	690,891	9,362,408
Unnamed causeway 3/1	Causeway	692,677	9,364,155
Kurur Bailey Br 3/9	Bridge, bailey	690,496	9,365,830
Panai causeway 3/8	Causeway	690,890	9,367,356
Puto causeway 3/7	Causeway	691,652	9,369,541
Ananasona causeway 3	Causeway	692,437	9,371,727
Genga Bailey Br 3/5	Bridge	691,990	9,373,826
Kara Bailey Br 3/4	Bridge	693,080	9,377,994
Namgan causeway 3/3	Causeway	696,537	9,381,285
Tendvasana causeway	Causeway	697,573	9,383,492
Mobe causeway 3/1	Causeway	698,810	9,384,901
Baniu (Chinpats) R causeway	Causeway	708,387	9,385,636
Saumitz River Bailey Br	Bridge, bailey	719,839	9,387,083
Ramazon River Bailey Br	Bridge, bailey	716,215	9,387,086
Kapua River causeway	Causeway	725,572	9,382,393
Tearouki River causeway	Causeway	727,530	9,382,072
causeway	Causeway	730,359	9,378,088
causeway	Causeway	730,500	9,377,609
Iaun River box culvert Nr25	Culvert	735,214	9,368,752
Uruai (Pitpit) River Br Nr24	Bridge, steel	734,409	9,363,102
Sivavi (Woruna) River Br Nr20	Bridge, steel truss	738,225	9,359,725
Aita River Br	Bridge, steel arch	737,697	9,356,248
Red River Bailey Br	Bridge, bailey	740,031	9,353,699
Uruavi River Nth bailey Br	Bridge, bailey	743,572	9,349,901
Uruavi River bailey Br Sth	Bridge, bailey	743,772	9,349,833
Numa River bailey Br	Bridge, bailey	746,704	9,350,488
Kaviri River causeway	Causeway (culvert?)	746,605	9,350,574
short causeway	Causeway / culvert	748,495	9,349,666
short causeway	Causeway / culvert	749,103	9,349,237
Koikoi River bailey Br	Bridge, bailey	750,153	9,348,489
Tekanu River Br	Bridge, steel truss	755,654	9,341,897
Keai River wet crossing	Wet Crossing	765,721	9,334,111
Arakawau River bailey bridge	Bridge, bailey	767,861	9,321,353
Pinei River bridge	Bridge	775,396	9,312,147
Bairama box culvert	box culvert	781,769	9,312,706
Bovo River bridge	Bridge, steel	783,485	9,311,406
Tupukas River bridge	Bridge, steel	784,094	9,311,359
Kerei River box culvert	box culvert	788,008	9,311,638
Baroku box culvert	box culvert	785,825	9,311,262

Kavara Stream box culvert	box culvert	786,322	9,311,325
Simpeng box culvert	box culvert	784,953	9,311,495
Kaperia box culvert	box culvert	783,222	9,311,545
Rigu Lagoon box culvert	box culvert	792,391	9,311,331
Toniva River bridge	Bridge	794,047	9,310,143
Ari'obau River bridge	Bridge	794,612	9,308,903
Toberoi Stream box culvert	box culvert	796,341	9,307,058
Aropa River bridge	Bridge	800,191	9,303,242
Sian River bridge	Bridge	803,262	9,300,013
Tavatava Creek bridge	Bridge	805,483	9,297,308
Kirei Stream bridge	Bridge	804,624	9,298,251
Metong River causeway	Causeway	808,710	9,296,430
Wauwa Creek causeway	Causeway	811,332	9,294,094
Gowena River causeway	Causeway	812,636	9,291,804
Pantanas River causeways	Causeway	811,537	9,293,708
Koaru River causeway	Causeway	813,140	9,290,388
Taki River bridge	Bridge	816,410	9,283,878
Toimanapu causeway Nr2	Causeway	816,103	9,285,228
Toimanapu causeway Nr1	Causeway	815,663	9,285,895
Laluai River bridge	Bridge	815,120	9,274,769
Oria River bridge	Bridge	810,846	9,271,624
Pirias River bridge	Bridge	809,558	9,270,449
Abia River bridge	Bridge	806,580	9,268,757
Mailai (Samiei) River bridge	Bridge	802,594	9,260,234
Muliko River bridge	Bridge	799,906	9,258,154
Ugumo River bridge	Bridge	797,773	9,256,851
Iga River bridge	Bridge	798,797	9,257,560
Lobi River bridge	Bridge	804,283	9,262,050
Sikabai River wet crossing	Wet Crossing	798,023	9,251,818
Poror River wet crossing	Wet Crossing	788,739	9,255,521
Silibai River crossing	Wet Crossing	792,723	9,254,230
Muage River wet crossing	Wet Crossing	790,818	9,255,421
Wamai River bridge	Bridge	783,554	9,252,174
Lobiai (Waipai) R wet xing	Wet Crossing	780,207	9,253,855
Meata bridge	Bridge	785,135	9,251,761
Mivo River wet crossing	Wet crossing	779,659	9,253,668
Mobiai River wet crossing	Wet Crossing	776,382	9,254,443
Sirokoro (Makapeka) R Bridge	Bridge	760,397	9,272,052
Uhai (Puriata) River bridge	Bridge	760,606	9,273,586
Hongorai River Bridge	Bridge	764,834	9,267,659
Pororei River wet crossing	Wet crossing	765,469	9,266,515
Sunin River wet crossing	Wet crossing	768,436	9,263,836
Torovira River causeway	Causeway	767,374	9,265,189
Toromi River wet crossing	Wet crossing	766,390	9,265,997
Tavera River wet crossing	Wet Crossing	758,204	9,282,146
Orei River bridge	Bridge	766,195	9,286,018
Munara River bridge	Bridge	765,179	9,283,875
Konara River bridge	Bridge	765,501	9,284,660
Jaba River bridge Nr1	Bridge	769,126	9,293,844
Nunopa River bridge	Bridge	768,153	9,290,458
Pangara River bridge	Bridge	769,759	9,291,692
Angorei River bridge	Bridge	768,319	9,288,970

## 8.7 Methodological considerations

The cost benefit analysis (CBA) is based on the following methodological considerations and assumptions.

### *The key role of peace*

The return of peace to Bougainville is accepted as the most significant in the betterment of living standards, agricultural production, and export activity. Therefore, any improvement in economic conditions can only partly be attributed to the AusAID projects. However, as the AusAID projects also helped to bolster peace, the issue of attribution becomes even more confounded.

### *Other aid activity affects assessment*

Other agents such as the PNG Cocoa and Coconut Extension Agency (CCEA), the EU and UNDP were active through their cocoa cropping and seedlings projects and the EU feeder roads project. NZAID was also involved in various aid activities. The Autonomous Region of Bougainville 2006 Budget reports the following donor funds: Australia K15.1 million, EU K5.2 million, NZAID K3.8 million, and UNDP K1.1 million. Total donor funds are estimated at K25.3 million in the budget, giving Australia a share of around 60% in donor funding. Hence, only a share of the benefits can be attributed to AusAID's activities.

### *Focus on significant measurable impacts*

Many social, environmental and economic benefits of the projects are difficult to quantify in dollar terms. For instance, where young men from different communities worked together on road construction projects in Bougainville, the reduction in unemployment coupled with positive social interaction may have had a positive, socially harmonising effect. Such benefits cannot be readily evaluated in monetary terms and should be considered 'over and above' those to which a financial value can be ascribed.

Similarly some negative effects of the projects cannot be measured but would reduce the value of the intervention. For example, building of roads may facilitate easier movement of rebels and therefore potentially the 'reach' or 'long arm' of terror. Such effects are unquantifiable.<sup>1</sup>

The CBA focuses on the main quantifiable benefits; reliable benefit estimates for smaller project components cannot be provided. Figure 3 illustrates that the major cost component relates to the roads related projects (BCTRRP and BCTRMP) which account for 63 percent of the AusAID expenditure covered in this analysis.

In declining order of importance, this CBA focuses on the roads projects, followed by the wharves projects and, finally, the dryer projects and the micro-credit schemes. With regard to each of these project activities, the study first defines and examines the benefit types that were expected to be large and second, characterizes benefits that were smaller or less likely to be quantifiable.

It is likely that improved market access will have impacted on other aspects of the economy such as horticulture and internal trade. Though potentially important, they have not been included in this CBA as being external to the remit of this study. While Sections 4.5 and 4.2.5.6 deal with some of these, it should be noted that the benefits are as yet too small to warrant a detailed cost-benefit analysis.

### *Which benefits are relevant?*

Many transport sector cost-benefit analyses in the OECD countries focus on estimating reduced journey times, increased travel comfort levels and reductions in accidents and road fatalities. Whilst such benefits can also be important in poorer countries, CBA experts of road rehabilitation projects in developing countries have argued that this approach can be too narrow and runs the risk of being of limited relevance in the developing country context. For a more detailed discussion of the shortcomings of road CBA methodologies in the developing country context see, the 'Rapid Literature Review: Impact Assessment of Developmental Road Works in PNG', prepared by ARRB Transport Research Ltd (2004). A narrow transport CBA methodology would exclude the wider economic impacts clearly targeted by AusAID in Bougainville. Such impacts are considered relevant for this CBA and include:

- increases in income (including export earnings or earnings from small income-generating projects);
- capacity building to sustain economic activity in the longer term, such as
- the creation of a small local contracting industry (e.g., road maintenance contractors and metal fabrication businesses); and
- the skills and tools required to add value to primary crops (e.g., dryers).

Due to a dearth of reliable time-series data for Bougainville, some of these benefits cannot be quantified. However, where data was available or could be generated indirectly, benefit estimates have been provided.

Double-counting of benefits has been carefully avoided. The study does not for example, count increases in household income from the extra value added by dryers in addition to increases in export revenue from (dry) cocoa.

### *The 'counterfactual' or 'base case'*

Probing the 'counterfactual' or 'base case' scenario is central to this CBA. It assesses project outcomes against the situation that might have prevailed in the absence of the AusAID projects.

Chapter 3.1.3 suggests a rapid rise in cocoa production with peace and the restoration of shipping in 1997. Later in 1999 a journalist reported that the recovery process was well underway by then:

The remarkable resilience that many people showed through the crisis has now been used to transform the island. In just a year Buka has been rebuilt from scratch, Arawa's local produce market thrives and flights from PNG are full of people coming and going for business or to see family now the blockade is over. The passion to rebuild Bougainville is palpable... (Ride, A. (1999), *The Rebel Peace*, New Internationalist, Issue 311, April 1999, accessed online on 27 November 2006).

However, in April 1999 the AusAID projects were in the early phases of implementation. Realistically under the counterfactual, economic activity (including exports), would not have remained completely stagnant. Therefore, in assessing the benefits generated by the aid projects, an allowance has been made for the likely growth that would have occurred in the absence of the projects.

### *The project horizon*

Many of the benefits of the aid projects will flow in future as the projects have been completed recently. In the absence of recurrent cost financing, the period for which benefits may be derived from the road transport projects will depend on how long it takes

the road to degrade to its pre-aid status. This might be as low as three to five years in areas of heavy rainfall in Bougainville and as high as 20 years in dryer areas. It will also be affected by levels of use, for which different projections are possible.

Similarly, new equipment will depreciate over time, suggesting that associated benefits here too will only be reaped for a limited period (say, 5 to 20 years). As noted in the main report, many mini dryers are beginning to wear and Kangu jetty is deteriorating due to previously unanticipated movements in the seabed.

Determining the length of time for which benefits are assumed to flow contains an arbitrary element. We examine each of the project streams independently and come to a 'considered opinion' regarding the possible timeframe within which benefits are likely to be reaped or to have been reaped. This is covered in the discussion of each project activity below.

### *Discounting*

Discounting is integral to CBA methodology. It involves the application of a discount rate to convert all costs and benefits to comparable 'present values' for the baseline year. However, the choice of the baseline year was not straightforward in this CBA because funding to and benefits from projects occurred in different years.

### *Baseline Year*

With projects commencing in different years (1998, 1999 and 2000), the baseline year for discounting values was not immediately evident. There was little justification in pegging the baseline to years 1998 or 1999 as only 0.5 percent of the total expenditure occurred before 2000. Discounting to 1998 would have seriously 'penalised' the projects that began later, and the rationale for this was weak. However, by 2000 three of the four projects had started and the fourth (BCTRMP) began just one year later. On balance, 2000 was considered the most appropriate baseline year for this CBA.

### *Discount Rate*

CBAs deal with costs and benefits occurring over many years. A discount rate is applied to reflect society's preference to receive benefits sooner rather than later. For individuals, time preference can be measured by the real interest rate on money lent or borrowed. Amongst other investments, people invest at fixed, low risk rates, hoping to receive more in the future (net of tax) to compensate for the deferral of consumption now. These real rates of return give some indication of their individual pure time preference rate. Societies prefer to receive goods and services sooner rather than later and defer costs to future generations. This is known as 'social time preference'; the 'social time preference rate' (STPR) is the rate at which society values the present compared to the future. ... The recommended discount rate is 3.5%. (Green Book, p. 26). Note that there is ongoing debate over the appropriate rate for use in public sector CBAs.

**Table 30. Social discount rates in UK public sector CBAs (Kula 2006).**

Type of rate	Magnitude
Test rate (first proposal) 1967	6%
Test rate (second proposal) 1968	10%
Required Rate of Return (third proposal) 1978	5%
Tradables (fourth proposal) 1989	8%
Non-tradables (fourth proposal) 1989	6%
Current declining rate (fifth proposal) 2003	3.50%



The Australian Government's '*Handbook of Cost-Benefit Analysis*' (Jan 2006) does not provide a benchmark discount rate. The Commonwealth of Australia (2006), *Handbook of Cost-Benefit Analysis*, Financial Management Reference Material No. 6, Department of Finance and Administration recommends the use of a cost of capital or producer rate of discount, which can be either the social opportunity cost of capital (SOC) rate or the project-specific cost of capital (PSCC) rate. The *Handbook of Cost-Benefit Analysis* states that the SOC is generally higher than the Government's bond rate normally represented by the long-term bond rate. From January to April 2007, this averaged around 5.8 percent in Australia. The PSCC is in turn generally higher than the SOC because the PSCC incorporates so-called country risk, which would be very high for Bougainville. The Handbook states that the PSCC is most appropriate when:

...the risk of a project is borne by specific lenders who require a higher real rate of return for participating in the project or where a project could be undertaken by the private sector. (p. 68)

As it is unlikely that the private sector (for which the PSCC is more relevant) would have ever undertaken these projects, the appropriate instrument for this CBA is the SOC. Hence, a real (i.e., inflation-adjusted) rate of 6 percent will be adopted in this CBA – this is marginally above the long term bond rate, but below commercial rates. An inflation-adjusted rate of 6 percent equates (roughly) to a nominal rate of 9 percent in the Australian context, or more than 9 percent when considering the rate of inflation on Bougainville during the period under review.

#### *Opportunity costs*

Some benefits produced by the AusAID projects – such as an increase in exports – could entail opportunity costs, diverting resources such as labour away from other potentially valuable uses. In Bougainville however, there is significant continuing unemployment and underemployment of resources, most importantly of rural 'family' labour. The opportunity costs of producing additional cocoa for export, for example by drawing family labour from kitchen garden production into cocoa production, are therefore negligible. On the other hand there is clearly some value in time savings to those travelling in Bougainville. Therefore, this CBA places a value on such time savings.

#### *Cumulative and 'stand-alone' benefits*

A final distinction is drawn between the direct or specific 'stand-alone' impacts of each of the project activities and their cumulative impacts. The projects are expected to have a cumulative impact beyond their individual stand-alone economic contribution.

## 8.8 Interviews noted

**Buka:** Mr Peter Tsiamalili, ABG Administrator; Raymond Masono, ABG Deputy Administrator; John Kolan, Ag/CEO, and Simeon Itamai, Engineer, ABG Div. Technical Services; Patrick Kolis, CEO, ABG Div. Economic Services; Tony Tsora, CEO, and Michael Meten, ABG Div. Education; Lawrence Disin, CEO, and Alois Pukienei, ABG Div. Health; Sam Gagau, CEO, ABG Divn. Human Resources; Peter Nomoreke, PMO, ABG Divn. of Forestry; Wendy Sawa, Agricultural Officer, ABG Div. Economic Services; Chris Kabobo, Agricultural Field Officer, ABG Div. Econ Services; Moses --, Cocoa Board Buka office; Jacob Banas, Regional Manager, Cocoa Board, Arawa (visiting); Francis Minbuna, Inspector, Cocoa Board Rabaul (visiting); Amos Baewa, Cocoa Growers Savings and Loan Society, Buka; Claire Toboen, Manager Agmark Pacific Limited, Kokopau branch; James Rutana and Boas Eliuda, Coconut Products Limited, Buka; Pio Murray, Harbourmaster, Buka.; Albert Kinane, Head Div. Economic Services, and Manager, South Bougainville Eng'g; David Boneham, owner/manager Eagle Hardware, Buka; Matthias Horn, owner/manager Buka Metal Fabricators; Fidelis Semaso, Manager, Pemana Limited, Buka; Aloysius Sohaga, Manager, and Clement Meka, Supervisor, Makerio Stevedores; Albert Mareh, Chris Textiles, Buka; John Cheung, Manager, Garamut, Kokopau office; Maggie Masiu, secretary, Catholic Education Office, Hahila; Robert Perakai, Manager, Inland Revenue Commission office, Buka; Jim Chalmers, UNDP Buka; Don Hurrell, AusAID Law and Justice Program; Bob Willis, Manager and Greg Telford, engineer, Road Consult; Roslyn Kenneth, AusAID Buka office; Tony Regan, Advisor to ABG; Bishop Hank Kronenburg, Roman Catholic Buka Diocese; Elizabeth Sawai, President, Bougainville Women's Council; Patrick Heromate, Chief Exec. Officer, Div. Local Level Government; Manager, Elementary Schools section, ABG Div. Education.

**Selau/Suir:** (Not visited by Project Director).

**Tinputz:** Joel Ababa, District Executive Manager; Mathew Taviriana, Principal, Tinputz STC; June Tukes, mini dryer owner Terio hamlet; Michael Oge (ex-Deputy PM), Suangu Village; Anna Vatoro, mini dryer owner Baven hamlet; Ruth Sima, mini dryer owner, Hiuraboni Village; Susan Apisio, mini dryer owner, -- hamlet 1; Viola Tusua, mini dryer owner, -- hamlet 2; Laydia Sandia, mini dryer owner, -- hamlet, Kasrus area; Beverly Denevi, Waropa; Rev. Francis Kavea, United Church; John Sisiasi, ex-District Manager; Reconciliation party waiting at Tinputz District Station.

**Wakunai District:** Jacob Rerevate, DPI Agricultural Officer; Augustine Niamis, Acting District Administrator, Wakunai District; Sam Kopa, Chairman Tera CoE; Martin Agoata, Elementary Trainer; Simon Kamai and Joel Vavi, Wakunai CoE members; Woman at Kaporivi Village, Togerau road; Dorcas Russel, mini dryer owner, Viporo Village, Rotokas; Rachel Purasiri, mini dryer owner, Rema Village, Rotokas.

**Arawa/Kieta:** District Executive Manager, Arawa; Rafael - , Central Bougainville Marketing Group; Rhoda Punjio, Pavarei Village, Arawa; Jerry Tunjio, (ex) BCCDRP Project Coordinator, Central Region; Lucy and Henry Sinei, chicken farmers, Duna hamlet; Carolyn Eval, second hand clothes dying business, Arawa; Raymond Memora, Chairman, Central PMV Association; Albert Reinhardt, Arevai Plant Hire; Road contractors in meeting, Arawa area; Benedict Erengeta, Manager Arawa RTC; Ludwina Dake, Women's rep, North Nasioi CoE; Charles Atave, Manager, B&K Plant Hire, Panguna; Joe Sidaung, Navueta Export; Arawa market inspector; Various trust fund project recipients; ; **Siwai;** (Not visited by Ian Scales); Anne Rangai, NGO leader.

**Kunua District:** (Not visited by Project Director).

**Buin District:** John Hanu, District Executive Manager; Paias Kipau, Agricultural Officer; Jacob Tooke; Tony Montai, fellow passenger to Kangu; Paul Tomitou, Buin District SDA Church; Market fee collector, Buin market; Resthouse owners, Kangu Beach; Various bystanders, Kangu beach; David Dadava, Orava Village near Tonolei Hbr.

**Torokina District:** John Tsianai, District Executive Manager; Robin Kenaus, guesthouse owner, Marowa Vlg.; Rose Saemos, BCCDRP bread oven recipient, Marowa Vlg.; Steven Suako, village store owner, Marowa Vlg.; Discussion group members, Torokina District Station; Farmers, Masamoa Village.

**Rabaul:** Nathan Wartovo, Head, Economics Section, Cocoa Board; David Aita, Cocoa Board; Claire Parik, Jenny Kulunto, Annie Arnold, Cocoa Board; Jochim Lummani, Head, Economics and Planning Section, CCI; John Nightingale, Managing Director, Agmark Pacific; Andrew Tore, Agmark Pacific.

# Acronyms

AAB	Australian Aid to Bougainville
ABG	Autonomous Bougainville Government
AUD	Australian Dollars
BCCRP	Bougainville Cocoa and Copra Rehabilitation Project (UNDP)
BCCDRP	Bougainville Cocoa and Copra Dryer Rehabilitation Project
BCTRRP	Bougainville Coastal Trunk Road Rehabilitation Project
BCTRMP	Bougainville Coastal Trunk Road Maintenance Project
BCL	Bougainville Copper Limited
BCR	Benefit-to-cost ratio
BWRP	Bougainville Wharves Rehabilitation Project
CBA	Cost-benefit analysis
CCEA	Cocoa and Coconut Extension Agency
COE	Council of Elders
CPL	Coconut Products Limited
CU	Census Unit
DES	Division of Economic Services, ABG
DPI	Division of Primary Industries, ABG
EU	European Union
GIS	Geographic information systems
HH	Household
IBPG	Interim Bougainville Provincial Government
IMPASS	Impact Assessment of Australian Aid to Bougainville
IRR	Internal rate of return
KIK	Kokonasi Industri Koporesen
LLG	Local level government
K	Kina
M	Million
NFS	National Forestry Service
PDD	Project Design Document
PMV	Public Motor Vehicle
PNG	Papua New Guinea
RCF	Recurrent cost financing
RDTF	Rural Development Trust Fund
RWA	Roads, wharves and agriculture
SMC	Smallholder market chain
UNDP	United Nations Development Program

## Currency:

Values are given in Australian dollars (\$) or Papua New Guinea kina (K) unless otherwise noted. One dollar = two kina approximately over the period 1999 to present.